CLAIMS ON CONSTRUCTION CONTRACTS: A NEW MANAGEMENT FRAMEWORK

WILLIAM VIDOGAH B.Sc.(Hons)

A thesis submitted in partial fulfilment of the requirements of the University of Wolverhampton for the Degree of Doctor of Philosophy

PhD *June 1997*

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This work or any part thereof has not been previously presented in any University or to any other body whether for the purposes of assessment, publication or for any other purpose. Save for express acknowledgements, references and/or bibliographies cited in the work. I confirm that the intellectual content of the work is the result of my efforts and of no other person.

Signature.........

Date....6|2|98.........

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Abbreviations

ABSCA	Aims Services Board of Contract Appeal
All ER	All England Law Reports
BCA	Board of Contract Appeals
BLR	Building Law Reports
Cl. Ct.	Claims Court
CLD	Construction Law Digest
CLJ	Construction Law Journal
CLR	Construction Law Reports
GSBCA	General Services Board of Contract Appeals
ICE	Institute of Civil Engineering
JCT	Joint Contracts Tribunal
NEC	New Engineering Contract
RIBA	Royal Institute of British Architects
TLR	Times Law reports
WLR	Weekly Law Reports

Abstract

The contractor is required to submit well argued statements of his entitlements upon the occurrence of defined events recognised by construction contracts. These are generally referred to as "*claims*". It is a matter of record that the high incidence of disputes are the result of such claims. Two main strands of research and expert commentary has been followed to stem this tide. The first focuses on ensuring that the legal implication of terms of contract are understood. The other attempts to ensure that there is equitable risk allocation under construction contracts. Some reported research indicates that poor quality of claims management practice was perhaps one of the most important factors responsible for this phenomenon. Unfortunately, there has been no reported research into the most deficient aspects of the claims management process. The general aim of the research reported in this thesis attempts to fill the gap in the construction industry's understanding of claims management.

The research involved: (i) an extensive review of the literature on claims, information management and technology; (ii) surveys and structured interviews of contractors and consultants and; (iii) case studies. The research confirmed the perceived central role of the Quantity Surveyor (QS) in claims management in addition to his traditional functions. It suggests that as a result of the QS's workloads, claims are usually left until projects are practically complete. Also contrary to conventional wisdom, most consultants to not object to the principle of claims but rather reject claims because of lack of factual evidence to support them. This deficiency in claim submissions from contractors is the result of lack of resources, the high cost of accessing the relevant paper records and/or the fact that information they submitted to support claims is usually captured by systems designed to produce internal accounting information which has, at best, only the most tenuous connection with claims. Further, although the technology required to reduce the expense of access to information from paper-sources is now well established, few contractors are

even beginning to appreciate the values of these systems. In addition no systems exist that are capable of supporting every aspect of claims management.

To improve the situation, the research proposes that : (i) a matrix of documents or their near equivalents that record resource use, performance and site events with reference to scheduled project activities be implemented; (ii) there should be a requirement to prepare and maintain resource-loaded CPM network schedules to aid the ascertainment of the cost and time impact of site events on specific activities. Standard specifications for these programmes and the minimum requirements for keeping site records should also be incorporated with all standard forms of building and civil engineering contracts; (iii) to ensure an adequate standard of claim documentation, it is desirable that the requirements for claim submittals should be specified at project inception; (iv) the problems with documents assembly, retrieval and access to data can be overcome through the implementation of electronic document management systems; (v) ideological training of personnel to use IT tools and understand the need to change current claims management practice should be undertaken and; (vi) the claims management function should be assigned to a member of the project team specifically trained on large and medium sizes projects.

CHAPTER ONE

GENERAL INTRODUCTION

1.1.0 Preamble

At the present time, the majority of the more substantial building and engineering projects in the United Kingdom are designed by a professional adviser of the employer, and are usually supervised and administered on the employer's behalf by this adviser during the execution of the projects. This relatively sophisticated arrangement has important managerial consequences. The main consequence is that, in general, the employer places far less reliance under such contracts on the skill and judgement of the contractor. This is particularly so in relation to design of the works, the choice of materials and their suitability for their intended purpose. This arrangement also has an important effect on the terms that can be implied in contracts, the interpretation of its express terms and has implications for the management of construction projects. Much of the modern law on building and engineering contracts has, as a result, evolved around this arrangement.

The resulting high incidence of litigation in. the construction industry of this arrangement is well documented. It is estimated that more than 80% of the business of the Official Referee's Court, the division of the High Court which settles commercial disputes, consists of construction litigation [1]. In most of these cases, the ability of project participants to document events, link such events to their impact on the project and consequently their effect on contractual rights and obligations has been called into question [2, 3]. O'Brien [4] suggests that, since it is the inability to establish cause and effect in the context of legal framework imposed by contracts that lead to litigation, it was possible that modern management techniques afforded to some extent by information technology can be applied to claims management. This research concerns the potential for reducing litigation through a change in project management culture facilitated by the incorporation into standard forms the requirements for documenting project activity and how this can be facilitated by applying Information Technology (IT).

The origin of construction disputes and litigation are claims made by parties for breaching the terms of their contractual arrangement. Claims are briefly defined in the next section to define the broad focus of the research.

1.2.0 Definition of Claims

A claim can be defined as a demand for remedy or compensation that is due under contract or common law [2, 3]. Claims can therefore, arise from civil liability in contract or tort for the breach of statutes or common law.

In legal terms, claims on construction projects fall under four main categories [2]: (i) contractual claims; (ii) ex-contractual or common law claims; (iii) *quantum meruit* claims ; and (iv) *ex gratia* awards or claims.

This research however, focuses on contractual claims. These include generally claims relating to unforeseen physical conditions, failure to supply information and drawings, variations, delays and other disruptions for which the contractor is generally entitled to claim additional cost and time extension under the terms of contracts entered into between the employer and the contractor.

1.3.0 Problem Definition

The Wood Report [5] referred to claims and variations as "*the most vexatious areas of contractual relationships.*" The Banwell Report [6] stated earlier that "*it would be to the benefit of the whole industry if the impact of claims was substantially reduced*" while the Harris Working Party [7] refers to the problem of claims settlement as "*probably the most difficult and controversial matter affecting relations in the construction industry*". These sentiments are echoed by Hughes [8] when he points out the term "*claim*" was likely to "*arouse emotions in the most matter-of-fact architect, engineer or quantity surveyor, a chill of apprehension or thrill of anticipation (according to one's point of view) in any contractor*".

Scott [9] more than a decade later argued that, the use of the word "*claim*" still arouses emotions very often accompanied by accusations and counter-accusations. This emotive atmosphere appears to prevail against the background of the acceptance that claims are a natural and inevitable consequence of the modern contract system [10]. In fact, it has been argued by some commentators that, this reality is recognised in the drafting of most standard forms of contracts [11].

Despite the acceptance of their inevitability on contracts, solutions for the problems associated with claims and disputes resolution have remained elusive. According to Jeargeas and Hartman [12], despite the existence of elaborate articles on the subject, industry' practices have not changed. The reason for this, argues Zack [13], is that while project complexity has increased and the cost of performing construction work has escalated, to some extent the quality of contract documents have declined and with it profit margins.

In an attempt to address some of the problems raised by contractual disputes and claims, the Construction Industry Institute (CII) of America, for example, proposes that parties to contract "start right" and "stay right" [14]. Starting right requires parties to contract to begin projects that includes suitable contract language and within an alternative dispute resolution (ADR) process. Staying right meaning that emerging disputes are resolved quickly before they develop into complex legal problems.

Adopting the parlance of the CII one can conclude that much of the research and literary work on this subject has been directed at how parties can "start right". The emphasis, by and large, has been on equitable risk allocation, better understanding and interpretation of contractual provisions and methods of quantifying claims.

The risk allocation theme is based on the concept of risk distribution. The philosophy is that the responsibility for a particular risk under contract should be allocated to the party best equipped to deal with it [15, 16, 17, 18]. For example, the foundation engineer should bear the consequences of any failures of his or her design and not the contractor who builds it. By evaluating terms of contract and identifying the common causes of claims and disputes [19, 12, 20] the exponents of this principle argue that improved drafting of provisions of contract is the key to the reduction of disputes. This concept of risk allocation lies behind the drafting of a new contract form by Hartman [21], the introduction of the New Engineering Contract [22], now revised and renamed the Engineering and Construction Contract in the United Kingdom, and the suggestion by the recent review of the state of the UK construction industry that most of the standard forms of contract should be redrafted [23].

Those who stress the need for improved understanding of the terms of contract such Powell-Smith and Sims [2], Trickey [24], Sweet [25], Thomas, Smith and Cummings [26], Goodacre and Hunter [11], to name but a few, suggest that dispute avoidance is facilitated to a large extent by proper interpretation of contract. Here, legal analysis is presented along with techniques for quantifying the common heads of claim. However, each of these excellent commentaries always state an important proviso: the claimant (in this case the contractor) is required in law, to substantiate every claim properly, preferably using detailed site documentation. Given this caveat, it may be argued that, these lines of research are manifestly limited in practical terms, for one simple reason. The interpretation of the terms of contract are sufficiently straight forward where disputes are largely about facts, rather than intricate legal rules [27]. Preliminary contacts with industry which preceded this research suggested that, in the majority of disputes, it is usually the facts that are in question and not the law.

There is no doubt that the issues of risk allocation and interpretation of rights and obligations under contract are important in contractual relations. However, it is a fact that claims and disputes in the industry have continued to increase [28, 29]. Considering that, successive reports on the UK construction industry have expressed dismay at the industry's reputation for litigation, it is apparent that, these lines of enquiry have had little impact. Diekmann and Girard's [14] attempt for example, to develop a system for predicting the likelihood of disputes on construction projects using the "dispute potential index" to provide the project teams with foreknowledge of projects with a high propensity towards contract dispute would be very useful only if the management issues raised by changes in the scope of projects are dealt with comprehensively. Diekmann and Girard's research in fact suggests that, apart from "people" issues, management was the most important factor which influences the likely occurrence of disputes.

Although the problem of ensuring equitable risk allocation and the lack of understanding of terms of contract are important, the investigation of the management demands of claims preparation and evaluation would greatly complement these efforts. The survey of arbitrators reported by Kangari [28] which found that proper project activity documentation influences dispute resolution reinforces the need for investigation of the management issues. The Wood Report [5] two decades earlier also made this very point, when it stated categorically that, claims could be speedily settled if there was a better appreciation of the need for proper documentation. The report emphasised that the "*lack of factual evidence is a prime cause of delayed payment*" and inevitably, protracted disputes.

On the whole, the main consequence of the emphasis on equitable risk allocation and interpretation of contracts is that, although ensuring payment of contractual claims is the ultimate goal of any construction claim, it is often treated as an afterthought in its preparation [30].

So what constitutes good claims management practice? Brewer [31], a director of a leading firm of construction contracts consultants, suggests an answer. The essence of claims management, he explains:

> *"is not to lodge a heavy document at the end of a project requesting additional expense and not call it a "claim". Instead the claimant should ensure that his fullest entitlements are identified on a month by month basis, with adequate detail to ensure that appropriate sums are paid through interim payments."*

The experience is that, this is the exception rather than the rule. The implication is that, without an adequate management set up to deal with claims, irrespective of the interpretation skills employed or the balance of risk allocation, protracted disputes will unfortunately be a permanent feature of construction projects. In effect, even if the parties "start right" it is not possible for them to "stay right."

If one were to accept the definition of claims management practice by Brewer [31] then, it is apparent that the efforts made so far do not to any extent resolve the practical management problems that changes in the economics of projects mean to the contractor. This is especially the case where the events affecting the project are within the control of the owner and his agents. Improving claims and dispute resolution therefore requires the investigation of the aspects of the claims management process that hinder proper preparation and evaluation of claims.

The main premise of this research is that, management problems have so far been given inadequate attention by researchers and expert commentators. This lack of appreciation of the burden of the process has lead some cynics to label claims management as a form of black art. Zack [13], for example, describes it as the practice of making and winning claims by questionable expedients without violating the rules or, even worse, an attempt to make a marginally profitable project more profitable. Based on the same premise, Foxhall [32] also suggests that contractors use claims to claw back uneconomic bids while Naoum [33] extols the virtues of management contracting as a means of preventing claims. Understanding the practical issues involved in claims management will go along way to dispel this attitude. The challenge which this research takes up is therefore to find efficient ways of preparing, evaluating and settling claims that can stand up to scrutiny by any objective assessor.

It has been argued by many commentators [2, 3, 12, 23] that, inadequate management of projects significantly impairs the contractor's ability to prepare well substantiated claims.

The author acknowledges that socio-economic factors influence the extent and frequency of disputes in the construction industry. These factors will always be present. This research however, attempts provide more efficient ways of managing claims within the context these socio-economic factors.

1.4.0 Research Aims

The broad aim of this research is to develop a framework for improving the management of contractual claims through changes to project management strategy and the adoption of information technology. In order to achieve this aim the following objectives were set:

1. review the literature on claims and disputes to identify and examine current and industry practices of claims management;

2. review case law to determine the requirements on claimants by the courts in preparing claims;

3. identify the potential areas of difficulty in the claims management process through a conceptual analysis based on the findings of objectives 1 and 2;

4. examine the current contractual framework to identify potential factors affecting the quality and efficiency claims management in the construction industry;

5. to identify the aspects of claims quantification that are responsible for disputes, identify deficiencies in project activity documentation, the resourcing of the claims management function and reasons for delays and costs in claims preparation;

6. evaluate the possible role of information technology for assisting the claims management process and develop an integrated model and identify the functional requirements of an information system to support the claims management function;

7. develop and evaluate a framework of proposals for better claims management on construction projects.

1.5.0 Methodology and Work Undertaken

The work undertaken was in three distinct stages. The first phase was to verify the premise argued in §§**1.3.0** that improved management of claims was required in order to reduce the costs and delays in claims preparation and consequently the tendency to litigate. An additional objective of this part of the research was to determine whether the effort required by the claims management process can be reduced by applying IT tools. This investigation was carried out mainly through literature review, a questionnaire survey, structured interviews and case studies to obtain additional information on the management problems associated with claims preparation and evaluation.

The literature relating to the issues pertinent to claims preparation and evaluation were reviewed and evaluated. Most of the literature available on the subject of claims and disputes discusses the techniques of quantification, appreciation of terms of contract and better risk allocation. As a result, very little has been written about the aspects of the claims management process responsible for delays and/or affects claims preparation and evaluation. This lack of understanding of the management process is reflected to some extent in the vague provisions in most standard forms for project documentation, programming of works and claims documentation.

The survey undertaken covered the whole of the UK over a period of six months and provided some interesting findings which were amplified by interviews with 10 senior construction industry practitioners and consultants.

The results of the survey suggests that several management problems hinder the proper preparation and evaluation of claims. It was evident that inadequate management was largely responsible for poor claims documentation and consequently, the industry's notoriety for litigation. Information management through better information access underlies the problem. Also the current project management set-ups are not geared to deal with claims comprehensively as the function is poorly resourced.

It became abundantly clear at the initial stage that, IT has a major role to play in effective management. This realisation made research into IT applications relevant to claims management imperative. This was achieved by drawing on the findings of the case studies, a structured systems analysis to establish the functional requirements of a computer-based system and the development of a limited prototype to prove the concept.

In the third stage, a number of proposals based on the findings of the research in the second and third stages were developed. These proposals were evaluated using expert opinion and redrafted for consideration by the construction industry as part of a concerted drive to reduce disputes.

The first phase of this research is documented in Part A. The second and third phases are documented in Part B and C, respectively.

1.6.0 Main Achievements

This research, has, through extensive literature search, case law review, postal surveys, interviews and case studies identified the main shortcomings in claims management practice, their extent and causes as a basis for proposing management changes and technology application to improve current practice.

The main achievements of the research are :(I) the identification of the main shortcomings in management practice; (ii) the development of a conceptual model for integrated information technology (IT) support for the claims management and; (iii) development of a framework of proposals for achieving better claims management.

Four papers [34, 35, 36, 37] have been published from the research whilst a further three are in the pipeline.

1.6.1 Main Shortcomings In Management Practice

In order to appreciate the management problems, the reasons for the rejection of claims which a claimant believes he is entitled is a good starting point. The reasons for rejection are closely related to the principle of the claim which was ranked above inadequate information by consultants in the postal survey. The research identified two main factors. First, contractors do not keep the records that are detailed enough to demonstrate the basis of their claims. Second, it has been suggested by many consultants that detailed information is often withheld as a tactic to cover inefficient project management or as a device to inflate claims. The later is supported by instances where previously unavailable records suddenly appeared when final accounts were being prepared or at legal proceedings.

Preparing claims requires time and entails some cost to the contractor. In order to address partly issues such as information provision, aspects of the claims preparation that involve most cost and time are important. The research suggests that as far as the contractor is concerned the identification of claims relevant information, their retrieval and claims document preparation involves the most cost and time. The main reason is that most of the site activity documentation are essentially paper-based. These paper-based sources of information required considerable effort in order to identify and retrieve the relevant information.

Another reason for the inability to prepare well argued claims submissions is lack of resources. The majority of the contractors involved in the research indicated that they could not divert limited resources available to claims preparation during construction. The practice was to leave any detailed investigation of claims until practical completion when resources can be freed. Consultants reject this practice.

Allied to the issue of resource availability is that of the responsibility for the claims management function. This research confirmed that the contractor's Quantity Surveyor (QS) plays that most important role in claims preparation. Apparently, the QS's knowledge of the costing of the works and its monitoring is used in claims preparation. Other projects team members such Project Managers, Site Planners/Agents appears to play subsidiary roles.

It is also evident from this research that claims preparation is not as yet regarded as a specialised project management function requiring the specific assignment of trained personnel. On the other hand such personnel may well exist but most contractors are reluctant to admit it for fear of being branded as "*claims conscious*". This is confirmed by the survey of contractors orientation to claims which did not show any strong inclination to pursue claims with all effort. However, the presence of job titles such as "Commercial Managers" and "Legal Advisors" indicates that such personnel may exist. This also confirms contractors' inclination to prepare claims themselves rather than use external consultants.

An important implication of this situation is that, the quality of claims documentation depends very much on the experience and skill of the QS whose traditional duty is to price changes, prepare valuations, vet quotations and monitor budgetary performance. The evidence is that the demands of these roles results in claims submissions being overlooked and hence the practice of postponing submissions until projects are practically complete. Claims as a consequence are managed on an *ad hoc* basis, with no defined or accepted principles of documentation, without the appropriate management set-up to deal with them and, naturally, with contractual framework that does not promote good practice.

A considerable amount of literature has been devoted to the explanation and demonstration of methods of quantifying and justifying heads of claim. Commentators agree that each head of claim presents its own special difficulties. The research confirmed that a major reason for the disagreements over the quantum of claims is the use of formulae. The preferred approach is that all claims should be quantified and justified using audited records.

Compared to all the other head of claims, the quantum and justification of on-site overheads appear to be the least likely to result in dispute. However, further investigation suggest that the item is often disputed because contractors tend to price it using the same percentage quoted in their original tenders. In addition to this, there is often a lack of records on plant and labour to support such claims. Two underlying issues related to the above is the problem of how the contractor's programme, which usually contains information on on-site activity is prepared and maintained, and whether the contemporary records intended to document projects are capable of supporting claims management at all.

The first manifests itself in the debate that surrounds disputes over claims for loss of productivity or disruption. The practice of many contractors is to use general percentages to quantify such claims. Consultants on the other hand prefer the use of contemporary records and a close analysis of the contractors programme required by contract. This could be done by relating the resource information in the programme to the contractor's records of labour and plant output on site. The main difficulty in the UK with this approach is that the preparation of resource-loaded programmes is not a requirement of most standard form. The consequence, is that, very often where programmes were prepared they did not represent the actual sequence of works, were never updated and were very often in the form of simplistic bar charts. The limitations of bar charts in disputes situation are well documented in literature [38].

The second issue relates to the nature of the contemporary records kept on projects. The case studies indicated that Quantity Surveyors relied mostly on cost reports designed for budgetary control to quantify claims. More significantly, available contemporary records were not only inaccessible because they were paper-based but were intended for cost accounting purposes. The normalisation of a sample of these records confirmed the inadequacy of current records.

1.6.2 A Conceptual Model for Integrated IT support for the claims management

Computers are being used in the management of claims. A number of systems have been designed for aspects of the claims management process. For example, expert systems for the assessment of extensions of time, determining whether ground conditions were unforeseeable or whether changes made by client to works was ground for compensation have been reported. Although most of these systems have not gone beyond the research stage, they nevertheless demonstrate the potential for further improvement. The main payoff in IT use however, will be in the areas of document management which appears to be capable of addressing the important problem of supporting the retrieval of supporting information. In view of recent developments on the software market, the possibility of designing dedicated systems that enables access through integration was explored in this research.

To this end, a conceptual model based on a structured systems analysis for integration was developed. The validation of the model by peers suggests that it is a good starting point for implementing an integrated computer-based system.

The implementation of the model has several implications because the software systems used in the construction industry are implemented in a wide range of hardware/software environments. In order to incorporate these applications as sub-systems of the proposed integrated system the question of compatibility has to be addressed. Although considerable progress has been made in the area of hardware compatibility, facilities for communication between the various software systems are still, at best, very rudimentary.

The problems raised by the lack of software compatibility also concerns the required expertise of the system's intended user and the data transfers across systems. Firstly, as the information requirements of a typical claim are scattered across the sub-systems the user would have to possess, at the very least, a fair understanding of the all these sub-systems. This knowledge would be additional to knowledge of construction methods, technology and construction law. The second problem is that, even assuming sufficient knowledge of the various systems, data transfer from one application to another, e.g., from a CPM software to an expert system, is cumbersome. With the current state of the software market, printing from source system and inputting into the target application would be required in most cases. However, with the recent alliances to establish protocols for Application Program Interchange (API) this problem is largely resolved. Therefore with further programming the integrated system can be delivered.

1.6.3 Proposals for Better Claims Management

To take advantage of these IT developments in light of the shortcomings of current claims management practice a number of proposals were made to the industry. These proposals were evaluated for their feasibility and suitability. Based on the results of the evaluation this research recommends the following:

1. A matrix of records that document site events, resource use and progress of work with respect to scheduled project activity will significantly reduce the difficulty of identifying, retrieving, assembling documents and preparing claims.

2. Standard specifications for preparing and maintaining resource loaded programmes of work should accompany every construction contract as a means aiding claims management.

3. Claims submissions should provide as an obligation a breakdown of costs of delays and disruptions with respect to each project activity.

4. Standard forms should include more demanding provisions to on the contractor's programming of work. This would lead to better claims management without changing significantly current legal obligations of parties to construction contracts.

5. Training of construction personnel needs to include the use of information technology for information management and claims. This is necessary to achieve better claims management within the context to the framework.

6. On medium to large construction projects the claims management function should be allocated to personnel trained to deal with them.

7. The possibility of using electronic document management systems to reduce the cost of managing claims relevant documents should be explored. This is because there strong indication based on their use in other industries that this technology can improve the contractors' ability to substantiate claims. The EDMS technology has a definite advantage over current document management practice but will need to be tried to gain a general use in the construction industry.

8. Provisions requiring the contractor to keep and allow the employer to audit records and submit the build-up of preliminaries and other bidding documents should be considered as a means aiding claims evaluation.

9. The industry should examine carefully the development and implementation of IT tools that can support all aspects of project management.

10. Terms stating figures normally in dispute for example, percentage of overhead recovery in the Hudsons/Emden formulae should be considered in contracts.

1.6.4 Recommendations for further research

1. The framework of proposals should be implemented on live projects to test their impact on claims management.

2. The construction industry should investigate the possibility of standardising site activity documentation on construction projects.

3. Further work should be carried out to completely develop and test a suite IT applications within the functional scope determined in Chapter Eleven to implement an integrated computer-based system for claims management.

1.7.0 Guide to the Thesis

1.7.1 PART A: Investigation of the nature of the problem

Chapter One: General Introduction: Introduces the main concept behind the research, presents a summary of work undertaken, the main achievements and gives a general guide to the contents of the thesis.

Chapter Two: Research Methodology: Explains the methodology adopted in the research, the reasons for them and how the adopted strategy facilitated the achievements of the research objectives.

Chapter Three: Principles of Construction Contract Claims :This chapter reviews case law and the literature on claims and dispute resolution to identify the basic elements of claims management. Established methods of claim quantification, justification and presentation are reviewed as a basis for identifying the potential problem areas of the claims management function.

Chapter Four: The Current Framework for Managing Claims: -This chapter reviews the contractual requirements for presenting and evaluating claims and the emphasis placed on project documentation and its possible impact on the claims management in practice and dispute resolution in general.

Chapter Five: Decision Making In The Management of Claims : In this chapter the decision making processes required for preparing and evaluating claims are examined with special emphasis on the information requirements of the various processes. The varied nature of the information sources and the potential difficulty of access are highlighted as part of the formulation of a conceptual model of the process.

Chapter Six : Analysis of Industry Survey: - In this chapter the results of the postal survey and interviews to clarify the main issues identified from the literature review and the analysis of the decision making process are presented. The significance of the findings are discussed as an overview of the current problems associated claims management .

Chapter Seven: Case Studies of Claims:- This chapter reports the main findings of case studies of actual claims situations and interviews with contractors' officers responsible for the claims preparation and evaluation carried out to clarify the main findings of the postal survey. This study provides the foundation for outlining the requirements of a computer-based system for claims management and proposals for improved claims management.

1.7.2 PART B: A Role for Information Technology In Claims Management

Chapter Eight: Generic Systems Used In Claims Management:- This chapter reviews the current and possible uses of general application software such database systems, scheduling packages and spreadsheets in claims management.

The limitations of these systems as tools for effective claims management are also highlighted.

Chapter Nine: Legal Expert Systems and Claims Management:- This chapter reviews implementations strategies for legal expert systems and examines reported systems to evaluate their potential role in an integrated computer-based system.

Chapter Ten: Electronic Document Management Solutions for Claims Management:- This chapter describes Electronic Document Management Systems, their capability to integrate the varied sources of information required for claims management and examines the benefits of adopting the technology as part of a computer-based solution.

Chapter Eleven: An Integrated Computer-Based System For Claims Management:- This chapter describes work carried out towards the development of a computer-based system for claims management and the results of testing the expert system module of the system.

1.7.3 PART C: The Management Framework for Better Claims Management

Chapter Twelve : A Framework For Better Claims Management :- Presents proposals designed to improve claims management in general and to facilitate the use of the proposed computer-based solution.

Chapter Thirteen: Evaluation of Framework Proposals:- Reports industry's response to the proposals outlined in Chapter Twelve

Chapter Fourteen: Conclusions and Recommendations:- Presents the main findings of the research and the recommendations.

Figure 1.1 illustrated the relationship between these chapters.

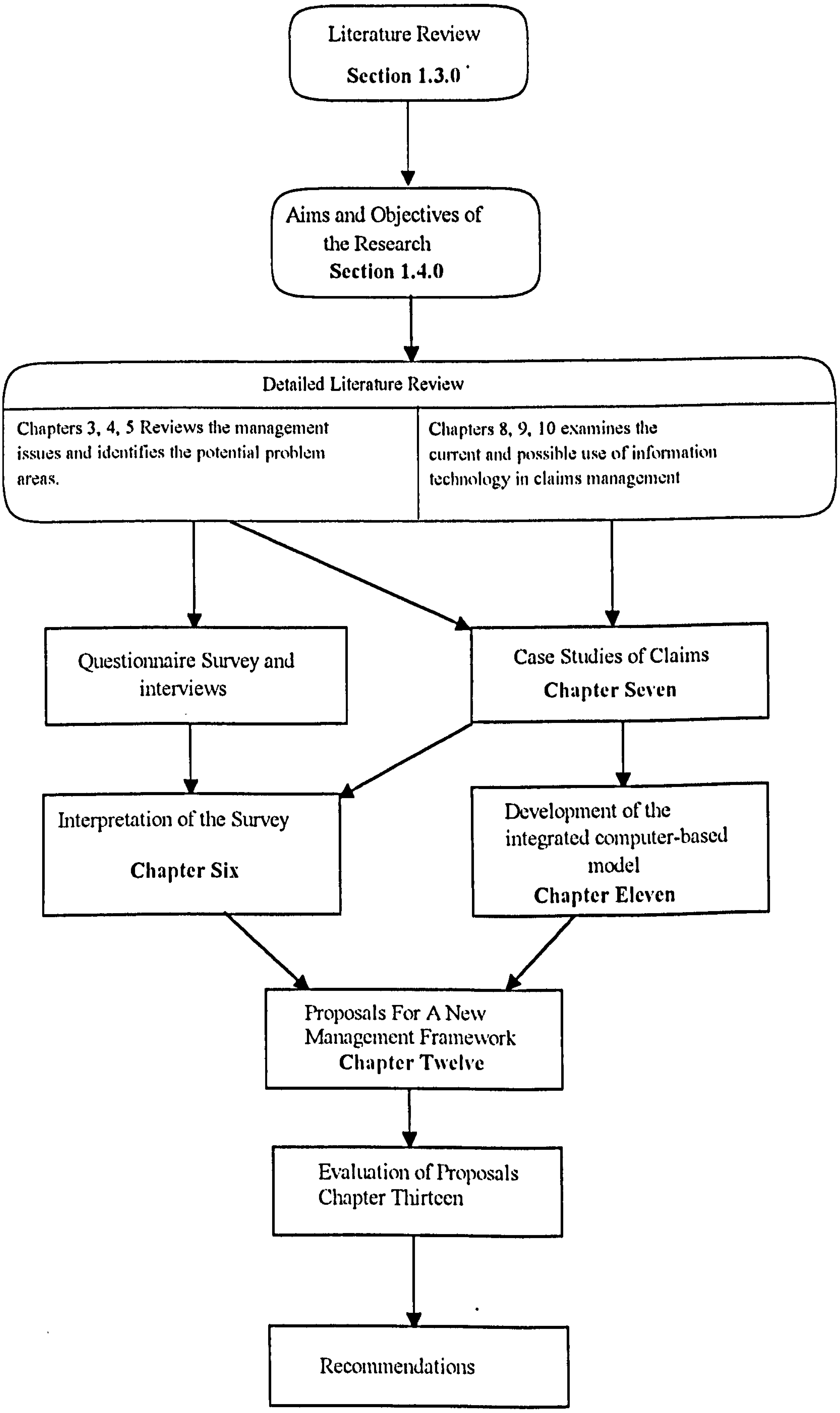


Figure 1.1 : Guide to the Thesis

CHAPTER TWO

RESEARCH METHODOLOGY

2.1. 0. Introduction

The preliminary literature review reported in Chapter One pointed to the need for the investigation of the management issues to complement current research. First, it appears that claims management was being conducted in an *ad-hoc* manner on most construction projects. Secondly, although the impact of claims on contractual relations is recognised, no definitive management set-up designed to deal with claims exist. Lastly, all the previously reported research and commentaries have concentrated mainly on legal evaluation along with techniques of claim quantification or better risk allocation as the principal means of reducing the tendency to litigate. None has really attempted to develop the management framework required for facilitating claims resolution. The primary objective of this research (§§1.4.0) is to evaluate current claims management practice on UK construction projects. Further to this, the research was aimed at developing a framework for better claims management supported by an adequately specified integrated computer-based system.

The concept of claims management adopted in the development of the methodology for this research is that of Brewer [31] and Currie, Sweeney and Kurtz [39]. Brewer [31] perceives successful claims management as the process that enables, a claimants fullest entitlement to be identified on a regular basis, with adequate detail to ensure that appropriate sums are paid through interim payments.

If good practice is to be ensured then, claims preparation and evaluation cannot be treated as an afterthought as being suggested [30]. The prudent and realistic project management set up should have systems and procedures to manage, monitor and document the work progress. Such a system should serve two important functions. First, to ensure an adequate flow of information to facilitate project control and co-ordination and second, aid in the compilation of an accurate and complete record of the job conditions and their impact on the duration and cost of projects [29].

The contractor in this respect certainly bears the bulk of the responsibility during construction. This is because, it is the contractor who installs the works and generally controls the means and methods employed to do so. The research methodology was therefore devised to identify the problems faced by the contractor and define the functional requirements a computer-based system supported by a management framework necessary to facilitate better claims management.

This chapter addresses the methodology of the research under the following main headings: (i) methods for data collection for the exploratory part of the research; (ii) the scope of the literature review; (iii) the design of survey questionnaires; (iv) the pilot study ; (v) the description and explanation of data analysis method used; (vi) methodology for developing an integrated computer-based model; (vii) the scope and content of case studies undertaken; and (viii) the development and evaluation of proposals.

2.2.0. Method of Data Collection

There are several ways of conducting an exploratory research. This includes surveys, experiments, case histories and the analysis of archival information [40]. Each strategy has its peculiar advantages and disadvantages depending upon three conditions: (i) the type of research question being answered; (ii) the control the researcher has behavioural events and (iii) the focus on contemporary as opposed to historical phenomena. For the initial exploratory part of this research various strategies were considered. These included, the most commonly used techniques in exploratory research such as [41]: (i) telephone interviews; (ii) person-to person interviews; and (iii) postal surveys.

2.2.1 Telephone Interviews

The telephone interview method is probably the cheapest and quickest technique of the three. It is also more flexible than mail survey and quicker than person-to-person interviews but capable of showing interviewer bias [42]. However, a better response rate can be obtained by this method. The main disadvantages of the telephone technique are those of questionnaire or measurements constraints, including limits on response alternatives. In addition, getting the person at the time of call could also be a problem.

2.2.2 Person-to-person interview

Person-to-person interviews are much more flexible than both telephone and postal survey techniques. It is usually possible to get more information by personal interview than either by telephone or mail. Longer interviews can be done in person. Rapport and confidence building are possible. The disadvantages of this method are that it is likely to be very costly for a large sample covering a large geographical area while total data collection period could be much longer than both telephone and mail techniques. In addition, skill and experience are required in the preparation for and the conduction of interviews [41].

2.2.3 Postal Survey

This involves sending the interviewee a questionnaire with a covering explanatory letter. Postal surveys are flexible and inexpensive but have as its main disadvantage a low response rate. Mail surveys provide many benefits to researchers. They can be comparatively inexpensive, allow respondents time to answer questions thoughtfully, reach large numbers of geographically dispersed and isolated respondents, and are free from interviewer bias in comparison with telephone and personal-interview surveys [41, 43].

The postal survey technique was adopted as part of this research because of its suitability for the scope of survey and sample size. Firstly, the Survey was intended to cover a large geographical area i.e. the whole of the United Kingdom. Secondly, it is the most convenient of the three methods for focusing the research on the main problems areas to be tackled within a reasonable cost and time frame.

However, non-response bias was a potential problem with mail survey questionnaire [43], i.e. the bias that occurs when the final sample differs in a systematic way from the planned sample. The work by Crozier [44] provides evidence that non-response bias may not be as serious as it has been stated to be. Crozier concluded from a review of a large number of comparable studies that, although there may be no hard evidence that non-response is necessarily a source of bias in all cases, few researchers would deny that a low response rate nevertheless causes them concern. His view is that, it is better to take steps prior to the posting of the questionnaire rather attempt to adjust for non-response when the scripts are returned. He suggested the following check list for 'maximising' response:

- respondent orientation - the questionnaire should be made very attractive to the prospective respondents;

- question content - the nature of the wording should be carefully chosen, as the ease of answering should be a primary consideration;
- sequence - logical flow of question;
- presentation - a printed questionnaire that is easy to read;
- the mailing - origin of the research, clear targeting on respondent, persuasive covering letter, return envelope (free-post), incentives;
- anonymity - for the respondent;
- follow-up;
- pre-testing and amendment.

To address these issues adequately, an eight part methodology was adopted for the research, namely:

- literature review;
- questionnaire design
- pilot survey;
- an industry wide survey of contractors and consultants;
- interviews and analysis of the survey;
- case studies of claims;
- systems analysis, development and testing of prototype system;
- development and evaluation of framework proposals.

2.3.0. Literature Review

The initial part of the methodology for this research was to conduct a comprehensive literature review on claims and dispute management in the UK construction industry. This review followed two parallel lines of investigation: the possible scope of Information Technology tools and the management issues that claims raise. The review covered a wide range of matters including: (i) the principles of claims preparation and evaluation (Chapter 3); (ii) the current contractual framework for claims management (Chapter 4); (iii) the use of computer applications in claims management (Chapter 8); (iv) the potential for expert systems (Chapter 9) and electronic document management (Chapter 10).

The literature review was then followed by interviews and preliminary consultation with a number of academic experts and consultants on claims and disputes in construction.

It has been emphasised that, much of the research aimed at improving claims management has tended to concentrate on interpretation of terms of contract or better risk allocation (§§1.3.0). Although the findings of such research undoubtedly contribute towards reducing the cost of litigation, the management problems raised by claims has not been investigated. The survey by Kangari [28] indicated that this is fundamental to the problem. This research therefore aims to investigate the aspects of claims preparation and evaluation responsible for delays and disputes as a basis for putting in place an appropriate management solution.

Due to the scope of the research: the geographical coverage, the number of respondents and different groups and firms to be considered, it was decided to use a self- administered postal survey questionnaire as the initial exploratory tool to focus on the main management issues. For this reason, the questionnaire was designed to prioritise the potential problems areas identified in the literature review. Feedback on the checklist (§§ **2.2.3**) was sought and questionnaire amended accordingly.

2.4.0 Questionnaire Design

The review of the principles applied in claims preparation and evaluation in Chapter Three, the examination of the current contractual framework (Chapter Four) and the conceptual analysis of the decision making process involved (Chapter Five) point to several practical management problems with current practice. The Wood Report [5] and Kangari [28] asserts that good project documentation could improve claims management. The questionnaire was therefore, designed and structured with the aim obtaining scaled judgements from the respondents on issues relating to the objectives of the research. Included within the structure of the questionnaire, were a number of areas. These included aspects of claim quantification that can lead to disputes, aspects of claims preparation responsible for delays, responsibility for claim preparation and evaluation and deficiencies in claim documentation.

2.5.0 The Pilot Survey

Having reviewed the literature on claims and disputes in construction (Chapters 3) and the adequacy of current contractual provisions (Chapter 4) the next objective was to identify and prioritise the practical problems encountered in claims preparation and evaluation in line with the research objectives set out in Chapter One (§§**1.4.0**). It was appreciated very early in the research from preliminary contacts that, the experience of claims situations vary. To ensure that the questionnaire was capable of aiding the research in establishing with some confidence the reasons for poor claims management practice, it was decided to undertake a pilot survey to:

- fine-tune the questionnaire, particularly regarding clarity, relevance and content;
- test the ease at which the questionnaire can be completed;
- test the applicability of scale and appropriateness of terms used in the questionnaire; and
- identify and prioritise the management aspects responsible for disputes and delays as a basis for developing IT solutions and proposing an improved management framework.

The questionnaire was pre-tested through a pilot survey of 50 construction firms and consultants selected from directory of organisations. The aim was to test for clarity and relevance of the research issues for which the questionnaire was designed to address.

Following the pilot survey, copies of the same questionnaire were sent to a leading claims consultant, Prof. MaCaffrey to evaluate closely. The responses and comment from the pilot survey and his expert opinion helped to ascertain the clarity needed for an in-depth understanding of current thoughts on claims management.

2.6.0. Industry-wide Survey of Contractors and Consultants

The questionnaire for industry-wide survey was structured in accordance with the aims and objectives of the research. This was to enable the main problem areas to be identified based upon the responses of the respondent companies and firms.

2.6.1. Sample Frame and Sampling Method

After deciding the methodology, the next step was the establishment of the criteria for sample selection in terms of: (i) geographical area of coverage; (ii) range of activities of respondents; (iii) size or turnover of firms to be covered. The aim was to give as broad a perspective as possible in contrasts to the common technique of concentrating the research in most cases on the top 50 construction companies.

In this research, it was considered important that in order to obtain a comprehensive overview of the extent of the management problems. It was therefore deemed necessary to use a sample which was representative of all categories of contractors and consultants in terms of geographical spread, size and experience. Hence, the selection of respondents was carried out to include: 200 Building and Civil engineering contracting companies, drawn up to include the top 100 companies in the UK as listed in Contractors File [45], a joint publication of Institute of Civil Engineers and Chartered Institute of Building, Business Directories, Construction Contract journals and Building Employers Confederation Directory; 200 Architectural consulting firms, drawn from Royal Institute of British Architects Directory of Practice [46]; 200 Civil/Structural Engineering consulting firms obtained from Association of Consulting Engineers and 200 Consulting Quantity Surveyors drawn from Royal Institute of Chartered Surveyor membership directory of 1995 [47].

The questionnaires were sent directly to individuals responsible for claims preparation and evaluation within each of the firms and, where there was no such a person, it was sent to the managing director or a principal partner as the case may be.

2.7.0. Method of Analysis

The choice of statistical test is one of the most important tasks any survey research has to address. The option selected must reflect the problem area being investigated and the answers the researcher is looking for in the study.

The subject of claims management and the issues this research aims to unravel are undoubtedly based on the experience of construction professionals. Opinions on such a controversial topic are most likely to be subjective in some respects. An objective analysis should of necessity measure the significance of the answers in as broad a perspective as possible. Definitive assumptions about the population parameters would therefore, flaw the research conclusions fundamentally. Consequently, it was decided to use non-parametric statistics which are distribution free, can deal directly with scores and remain valid even when the normality assumptions are violated.

A number of such tests meet these criteria [48]. The Kendall Concordance Test [49] was used in analysing the postal survey.

2.7.1 Kendall's Concordance Test

Correlation tests focus on agreement between sets of ranks rather than their differences. This concept is extended to the many variable instances where the interest is on the level of agreement between any number of sets of rankings. This concept dubbed the concordance test is extended to the many variable instance where the main interest is in the level of agreement and its significance [48, 50]. This technique attributed to Kendall [49], who devised the statistic W which measures the level of agreement among k judges ranking n factors or aspects of a problem.

2.7.1.1 Estimating Concordance *W*

Assume that k respondents are asked to rate n aspects of a problem using a specified scale to measure their influence. The concordance W, based on the ratings is given by the formula :

$$W = \frac{S(R_i - R)^2}{n(n^2 - 1)/12} \qquad (1)$$

where $R_i = R_{1,n} + R_{2,n} + R_{3,n} + \ldots\ldots + R_{k,n} = \{ {}^{n}S_{i=1} R_{i,n} / k \}$

and $R = \{ {}^{n}S_{i=1} R_i / n \}$.

k = number of sets of rankings (aspects of problem being ranked)

n = number of judges

Ri = average of ranks assigned to the ith aspect of a problem

R = mean of ranks assigned across objects or aspects of a problem.

$n\ (n^2 - 1)$ = maximum possible number of squared deviations i.e. the numerator which will occur if there were perfect agreement among the rankings.

This statistic generated varies between 0 and +1 regardless of the number of sets of rankings because, where more than two sets of ranks are involved, the respondents cannot disagree completely. For instance , if respondent A and B are in disagreement and A is also in disagreement with C, then B and C must agree. Meaning that where two or more respondents are involved agreement and disagreement are not symmetrical opposites. The Kendall's coefficient W, must either be zero or positive. The numerator of the formula thus represents the degree of the divergence of the rankings. Where there is no agreement, the divergence is zero i.e. each factor of a problem is equally important.

2.7.1.2 Testing the significance of Kendall's Coefficient

Where the number of respondents k ³ 7, the chi-square value for this statistic is given by:

$$X^2_o = k(n - 1)\, W \qquad (2)$$

This observed value X^2_o is approximately distributed as the X^2-distribution with n -1 degrees of freedom (df). The null hypothesis H_o that the level of concordance indicated by the value of W is by chance can be rejected with confidence where X^2_o ³ X^2. The alternative hypothesis H_1 that the order of ranks reflects the level of importance or influence of each aspect of a problem is then accepted. In statistical terms the result is significant.

2.7.1.3 Interpreting W

Where the value of W is high or significant it can be inferred that the k respondents are applying the same yardstick in rating the n factors of the problem under study. This pooled ordering of ranks can then be used as a basis for making judgements about the importance of each factor. The detailed use of this statistics is discussed in detail by Siegel and Castellan [50].

Kendall [49] its originator however suggests that, the statistic is most useful when W is significant. So that, if one accepts the criteria used by the respondents (evidenced by the magnitude and significance of W), then the order of ranks indicates the importance of each factor. This implies that the most important factor or aspect of a problem is the highest ranking one or vice versa.

2.7.1.4 Interpreting the survey

For example, one question in the contractors questionnaire required them to rate the time required to undertake a number of aspects of claims preparation on 0 - 10 scale (where 0 = very low to 10 = very high). The aspects included, identifying claims relevant information (A1), identifying sources of information (A2), claims quantification (A3), claim justification (A4), preparing the claims document (A5), responding to requests for further information (A6) and retrieving claims relevant information (A7). The results of the response can be tabulated say for seven consultants in Table 2.1.

Table 2.1: Example of interpretation of concordance

Grounds for rejecting contractors' claims							
Ranks	A1	A2	A3	A4	A5	A6	A7
Contractor							
C_1	8	7	6	5	4	3	2
C_2	10	9	8	7	6	5	3
C_3	9	8	7	6	5	4	4
C_4	8	7	5	4	3	6	7
C_5	7	6	6	5	5	3	2
C_6	8	7	8	7	6	4	3
C_7	9	8	7	6	5	7	6
Sum of ratings(**Ri**)	59	52	47	40	36	32	27
Mean rating	8.43	7.43	6.71	5.71	5.14	4.57	3.85

From Table 2.1 the rank totals (ratings) are 59, 52, 47, 40, 36, 32 and 27 respectively, and the average rankings are 8.43, 7.43, 6.71, 5.71, 5.14, 4.57 and 3.85 respectively. The grand mean of these averages is 4.96. To obtain the numerator of W in equation (1), the square of deviations of each average rank from the mean value is obtained and summed.

$$\mathbf{S}\,(\mathbf{R}_i - \mathbf{R})^2 = (8.43 - 4.96)^2 + (7.43 - 4.96)^2 + (6.71 - 4.96)^2 + (5.71 - 4.96)^2$$

$$(5.14 - 4.96)^2 + (4.57 - 4.96)^2 + (3.85 - 4.96)^2$$

$$= 21.38$$

Since n = 7, the value of the coefficient of concordance from the data in Table 2.1 using equation (1):

$$W = 21.38 \,/\, \{7(7^2 - 1)/12\}$$
$$= 0.764$$

$W = 0.764$ expresses the degree of agreement among the contractors in rating the time consuming aspects of claims preparation and evaluation. Using equation (2) the observed chi-square value is given by:

$$X^2_o = 7(7 - 1)\, 0.764$$
$$= 32.09$$

Referring to the critical values on the X^2-distribution table (Appendix 1) with a degree of freedom:

$$\text{df} = n - 1 = 7 - 1 = 6$$

At 95% confidence level the observed value $X^2_o > X^2$. We can reject the null hypothesis H_0 that the concordance between the contractors is by chance with confidence. The agreement between the contractors is therefore statistically significant, i.e. the most time consuming aspect of claims preparation and evaluation are the identification of sources of claims relevant information and the quantification of claims in the order of their ranking. The 95% confidence interval is used for data analysis.

Due to the exploratory nature of this research, it was necessary that the data be analysed with the objectives of the research in mind. The information needs of the research, having been translated into types of data, required appropriate manipulation to address these needs. The data was coded into a computer package [51]. The interpretation of the data collected from the survey is detailed in Chapter Six.

2.7.2 Method of Sorting out Samples

In sorting out the sample, the respondents were categorised into four distinctive groups - Architects, Civil/Structural Engineers, Quantity Surveyors and Contractors. The objective was to investigate if there is any convergence of opinion on the most problematic aspects of claims management in each of these groups.

2.8. 0 Case Studies of claims

From the preliminary analysis of the survey and subsequent interviews, several issues emerged which needed proper investigation in order to understand fully the management problems associated with real claim situations. In addition, the case studies of actual claims would enable the actual claims management process to be identified, analysed and evaluated for possible IT solutions to be devised. In order to address these issues, case studies of real claims were undertaken. The objective was to:

- determine the aspects of claims preparation and evaluation responsible for disputes, delays and costs to support the findings of the survey;
- establish claims-relevant information flow among project participants and within the contracting organisation's management set-up as basis for defining the functional requirement of an appropriate computer-based system and;
- determine the adequacy of the main sources of information for justifying and quantifying claims.

The first objective was met partly by the questionnaire survey and interviews. The case studies are appropriate for the second and third objectives. The findings of the survey and interviews (Chapter Six) and the case studies (Chapter Seven) led to the development of the framework proposals (Chapter Twelve) and the proposed model for an integrated computer-based system (Chapter Eleven). The proposed model follows in part from the findings of the review of available generic systems detailed in Chapters Eight, Nine and Ten.

2.9.0 Developing the Integrated Computer-based Model

The first stage in the development of any computer-based system is the analysis of the current system whether manual or computerised. Systems analysis is a method for developing computer-based systems with well defined phases, recommended for planning, control and evaluation of the software development process. In general the methodology applied to systems development passes through the System's Development Life Cycle (SDLC) consisting of the iteration of the following activities: systems investigation and analysis, systems design, software development, testing and implementation and maintenance and evaluation. This establishes a standard sequence of steps with regards to all computer application systems, whether they are totally computerised or contain manual interface operations [52, 53]. The research reported in this thesis due to limitations of resources concentrates on the systems investigation and design stages of the life cycle.

The systems investigation and analysis involved fact finding and analysis to describe the essential operational requirements of existing systems that perform aspects of claims management. The purpose is to determine the existence of problems, ascertain their nature and scope as well as possible solutions. This resulted in a definition of the output required from the system, input data needed to generate the output information, the processing involved, interface requirements and the operational objectives.

Systems design refers to the entire system and may be seen as a process of translating the specifications of required facilities and interface into a useable system [53]. Two main strands of systems design can be recognised: (i) interface design which determines the requirements relating to all aspects of human-computer interaction and; (ii) design of application software which determines the computer programming necessary to produce the desired facilities.

Software development process involves selecting the programming language or development environment as the case may be, to determine the general guidelines, coding and testing of modules. Based on consideration of hardware/software limitations a choice is made which in this instance is a combination of knowledge engineering language and the use of a fourth generation language (4GL).

The terms of reference for the design of the required system in this instance includes : (i) the examination of the process of claims evaluation: justification, quantification and presentation of pleadings (Chapter Five); (ii) appraisal, review and evaluation of the information requirement for claims management with the view of defining the system's objectives (§§**7.2.0**); (iii) a broad definition of the structure and scope of a computer-based solution to meet the system's objectives; (iv) identification of viable sub-systems and determination of development priorities for each, taking cognisance of interface requirements and; (v) identification of organisational and human constraints to the system.

Based on the review of literature (Chapter Three), the analysis of the decision making process (Chapter Five) interviews of potential users (mainly QSs) and case studies (Chapter Seven) the basis for the outline of the proposed system was established. The system is outlined with reference to: system processes, systems structure and data flow between processes and entities with respect to functionality of an integrated computer-based system. The conceptual computer-based model described subsequently in this Chapter Eleven is the result of this investigation.

2.9.1 System Analysis

The analysis of the system for claims management was based on the authors observations and examination of relevant records during the case studies. The system was documented using the Structured Systems Analysis Design Methodology (SSADM) notation which is the standard protocol for software systems development in the UK [54]. The case tool SELECT available at the University was used for this process. This analysis involved :(i) the normalisation and rationalisation claims relevant documents and; (ii) developing the process model of the system using data flow diagrams.

2.9.1.1 Normalisation and Rationalisation of Records

This stage of the systems analysis involved the normalisation and rationalisation of claims relevant documents (including samples of site records, cost reports and accounting records used in claims preparation). This technique used in the design of pure database systems removes duplication in recording data, links records to create a database capable of supporting fully the management function under investigation [54]. Samples of the normalised records are in Appendix 2.

2.9.1.2 Developing The Process Model Using Data Flow Diagrams

After the completion of normalisation process the system processes were then analysed using the case tool. The data flow diagrams were used to document the observed processes. Based on these data flows a rationalised data flow model was derived. With this outcome, the functional requirements and structure of the required system were developed. Chapter Eleven reports the results of this process, discusses the system concept, its implementation implications and describes the expert system module. Appendix 3 illustrates the process of using the structured system methodology.

2.10.0 Development and Evaluation of the Framework proposals

In developing these proposals, the fundamental project management issues that affect claims management were taken into consideration on basis of the findings of the exploratory part of the research (Part A). Seven main recommendations put forward in Chapter Twelve are based the following themes echoed by the postal survey and interviews (Chapter Six) and the case studies of claims (Chapter Seven):

- the need for improved project documentation;
- incorporating the preparation and specification of schedules as a vital project management strategy;
- moving some way to specify or improve methods of claims documentation;
- the need adoption of technologies capable of reducing the effort the process of claims management requires and;
- changing current project management culture.

2.10.1 Evaluating the Proposals

To evaluate the main findings and recommendation of this research, two main options were considered namely, quantitative and qualitative validation.

2.10.1.1 Quantitative Validity in Research

The attainment of validity is one of the basic principles of research. Validity means the ability to produce findings that are in agreement with theoretical or conceptual values: to produce accurate results and to measure what is supposed to measured. If an instrument employed to measure the extent of cheating in examinations revealed that 32% of the students regularly cheat, the measure used has validity if the proportion of .students who cheat is actually 32 per cent. A valid measure produces true results that reflect the true situation and conditions of the environment it is supposed to study.

There are two ways of checking the validity of an instrument: (i) empirical validation and; (ii) theoretical validation. In the former, the validity of a measure is checked against empirical evidence. In the latter, the validity of an instrument is ascertained through theoretical or conceptual constructs. In both cases, validity is claimed if the findings produced through the measure in question are supported by empirical evidence or by theoretical principles.

Empirical Validation

Empirical validation, as described above, tests pragmatic or criterion validity. If an instrument, for instance has produced results indicating that students involved in student Union activities do better in their exams, and if this is supported by available data, the instrument in question has pragmatic validity. Again validity here is assumed if the findings obtained through a measure are supported by already existing empirical evidence. In this case the validity is concurrent validity.

Quite often, the validity of a measure is checked by the degree to which predictions made by the results of this measure are supported by findings that appear later. Validity is then claimed if new data support the predictions of the measure in question. For example, if a study found that an eventual introduction of advanced statistics into the social sciences degree would result in a significant drop-out of ethnic students, and if this prediction in the meantime was found to be correct, the measure has validity. This is known as predictive validity.

Theoretical Validation

Theoretical or conceptual validation is employed when empirical confirmation of validity is difficult or not possible. A measure is taken to have theoretical validity if its findings comply with the theoretical principles of the discipline, that is, if they do not contradict already established rules of the discipline. There are several types of theoretical validity.

Face validity

An instrument has face validity if it seems to measure what it is expected to measure. "*On the face of it*" it appears to have validity. For example, a questionnaire aimed at studying sex discrimination has face validity if its questions refer to discrimination due to sex. The standards of judgement here are not based on empirical evidence, as it was in the case of the other type of validation, but on general theoretical standards and principles, and on the subjective judgement of the researcher.

Content Validity

A measure is supposed to have content validity if it covers all possible aspects of the research topic. If a measure of alienation, for instance, does not include normalness or powerlessness (two elements generally considered to be important aspects of alienation) the researchers cannot claim content validity of this measurement.

Construct Validity

A measure can claim construct validity if its theoretical construct is valid. For this reason, validation concentrates on the validity of the theoretical construct. An example of this validation proceeds as follows. If discrimination of female students on campus is the research topic, an instrument is constructed to study this topic. Then two student groups known to differ in their views on basic issues related to the research question are identified. Next, the instrument whose validity is to be checked is administered to both groups and the results recorded separately for each group. If the findings obtained from each group differ, the instrument is thought to have construct validity.

Another example: To test the validity of a questionnaire developed to measure the attitudes of female students to student administration of their institution, a questionnaire is constructed and then administered to both male and female students, two groups already known to have different attitudes to the research issue. The results of each group are checked with regard to whether they differ from each other. If it is found that the attitudes of male and female students are different on the research issue, the instrument is thought to have construct validity.

Other forms of validity

There are two other forms of validity: internal validity and external validity. The former relates to the instrument's significance for the study situation; the latter is associated with the generalisability of the findings gathered by means of the instrument in question.

2.10.1.2 Validity in Qualitative Research

Validity is a methodological element not only of quantitative but also of qualitative research. Qualitative researchers try to achieve validity not through manipulation of variables, but rather through their orientation towards, and the study of, the empirical world. Blumer [55], for example through construction of appropriate methods of data collection and analysis [56] or through specific measures such as communicative, cumulative, ecological or argumentative validity [57]. There are several types of validation associated with qualitative research [58, 59]. These are briefly introduced.

Cumulative validation

A study can be validated if its findings are supported by other studies. The reader can compare the various findings and make a judgement about the validity of the studies.

Communicative validation

The validity of the findings can also be ensured through additional questioning of the respondents; the researcher is then expected to re-enter the field and collect additional data.

Argumentative validation

This form of validity is established through presentation of the findings in such a way that conclusions can be followed and tested [60].

Ecological Validation

A study is thought to be valid if carried out in the natural environment of the subjects, using suitable methods and taking into consideration the life and conditions of the researched.

Other 'Tactics'

In a different manner, Miles and Huberman [61] suggest 'tactics' for testing or confirming findings, which, although not direct forms of validity have a similar function In a sense they are similar to those presented above (e.g. cumulative or communicative validation); others seem to be close to the form of validation employed by quantitative researchers. The tactics these writers propose are as follows:

Checking for representativeness :- The findings are confirmed by manipulating the sample, for example by increasing the sample size or adding contrasting cases, and observing whether the findings are changed in anyway.

***Checking for researcher effects*:-** This includes avoiding or preventing effects of the researcher on the site and of the site on the researcher. Avoiding elite bias, showing the notes to another researcher to check, staying in the site for as long as possible, using unobtrusive methods and explaining the purpose of the study clearly are some of the ways that can help to reduce researcher effects.

***Triangulation*:-** Here, the quality of findings is tested through triangulating not only with methods but also with other researchers.

***Weighting of evidence*:-** Testing the quality of the findings can be accomplished also through weighting the evidence that supports them, for example by using better informants, collecting data under better circumstances and through validating the data.

***Making contrasts and comparisons*:-** Using the method of differences, findings can be contrasted or compared with other findings. This can help to identify strengths and uncover weaknesses in the data.

***Checking the meaning of outliners and extreme cases*:-** Studying extreme cases and unusual events provides information that can be very useful in identifying the strength of the findings and therefore the quality of the conclusions .

***Ruling out spurious relations*:-** This is a very useful concept and it will certainly benefit evaluation of the data. However, spuriousness has to be identified, and this is not a very simple task; this procedure may then replace one problem with another.

***Replacing a finding*:-** This is supposed to offer additional information, which is expected to be similar to or different from that obtained originally. Replication is expected to strengthen or weaken the original finding.

Checking out rival explanations:- Such explanations might throw light on different impressions and allow a more accurate evaluation of the original findings.

Looking for negative evidence:- This operates in a manner similar to the previous tactic.

Getting feedback from informants- The quality of findings or conclusions can be checked through informants, who may be respondents or a panel of judges. It is hoped that their opinions will allow judgements about the quality of the original findings. If they are disputed by the respondents or judges their quality is obviously questionable.

Pluralist nature of qualitative research:- To demonstrate the diversity of opinion as well as the pluralist nature of qualitative research this chapter finally refers to Lincoln and Guba's [62] attempt to cope with the traditional demand for every research output to meet standards and principles of evaluation. Lincoln and Guba [62] propose four alternatives to validity, reliability, generalisability and objectivity, namely credibility, transferability, dependability, and confirmability. In their view: (i) in qualitative research investigators do not need to demonstrate validity but rather methodological excellence, that is, doing research in a professional, accurate and systematic manner; (ii) instead of generalisability, transferability is suggested. This means that the researcher should state how research was undertaken, explain methods, instruments and parameters, leaving it up to those who are interested in the findings to decide whether they can be generalised or not, and to also use triangulation; (iii) on the notion of consistency and reliability, Lincoln and Guba suggest that, in a constantly changing world, dependability is the closest one gets to reliability; (iv) instead of aiming for objectivity, confirmability is proposed. Confirming data shifts evaluation from the researcher, who was the centre of objectivity, to the data themselves.

Value of validation of qualitative research

The above forms of validation, especially cumulative, communicative, argumentative and ecological validation, are thought to be effective and to allow qualitative researchers to achieve not only validity but also, at least in the opinion of some writers, a higher degree of validity than quantitative researchers achieve. Lamnek [59] argues that, qualitative studies achieve higher validity for the following reasons:

- in qualitative research the data are closer to the research field than in quantitative research.;
- the collection of information is not determined by research screens and directives;
- the data are closer to reality than in quantitative research;
- in qualitative research, the opinions and views of the researched are considered;
- the methods are more open and flexible than in quantitative research;
- in qualitative studies, there is a communicative basis that is not available in quantitative research;
- a successive expansion of data is possible.

Three options for evaluating the proposals were considered: (i) case studies; (ii) postal survey and; (ii) interviews. Case studies would have provided the best method of validating the proposals. However, its suitability is handicapped by the time and cost limitation of the research and the difficulty of finding organisations willing to implement the proposals on a live project. Postal survey was considered too restrictive. This research adopts the feedback method set out under other tactics (§§**2.9.1.2**) to qualitatively evaluate the proposals. The findings of the validation exercise are reported in Chapter Thirteen.

2.11.0. Summary

The methodology adopted for this research involved first, a comprehensive literature review and a pilot survey to fine tune the research questionnaire to conduct an industry-wide survey of contractors and consulting firms. Case studies of claims were undertaken, leading to the development of proposals for improving claims management and outlines of a suitable computer-based system to support the full implementation of the proposals.

The method of self-administered postal questionnaire survey was adopted to explore the main management issues involved in the preparation and evaluation of claims. This was followed by interviews a number of respondents. The case studies clarified the problem areas and formed the bases for outlining the functional requirements of an integrated computer-based system and the formulation of the proposals for improved claims management.

CHAPTER THREE

PRINCIPLES OF CLAIMS PREPARATION AND EVALUATION

3.1.0 Introduction

Claims preparation, evaluation and settlement has become an important topic in seminars and conferences related to the management of construction projects. The importance of this subject is illustrated by a recent study of 24 Canadian construction projects which found that over half the claims made on these projects exceeded 60% of the original contract value [19]. A major part of such deliberations focus on the interpretation of case law, deals with the entitlement of parties, quantification of claims and also raise important issues that construction professionals need to bear in mind whether they are preparing claims or evaluating them.

An understanding the basic legal principles employed in contract law as applied by the courts is required by project participants whether they are seeking reimbursement for additional expenditure under contract or damages at common law.

In this vein, this chapter identifies main categories of claims, the basic issues common to all claims and disputes and then, reviews the legal principles applied in claims management. The basic legal principles are briefly examined followed by a review of common contractual provisions on claims and the quantification techniques of heads of claim. The aim is to illustrate the principles adopted in justifying and quantifying the common heads of claims in order to identify potential problem areas in claims preparation and evaluation.

3.2.0 Categories of Claims

In legal terms, claims on construction projects fall under four main categories [2]: (i) contractual claims; (ii) ex-contractual or common law claims; (iii) *quantum Merit* claims; and (iv) *ex gratia* awards or claims.

3.2.1 Contractual claims

These arise from express or implied provisions of a contract e.g., claims for loss and or expense under particular provisions of contract. Most civil and building contracts define such claims to cover events such as delays and disruptions caused by the late issue of instructions and drawings by designer and variations made by the employer.

3.2.2 Ex-contractual claims

These are claims for damages for breach of contract at common law and/or legally enforceable claims for breach of some aspect of the law. The entitlement for some of these claims are provided for expressly in most standard forms of contract. As a general rule in most standard contract forms, parties to these contract do not loose their common law rights on any issue unless [24]: (i) the terms of the contract makes clear rules on the issue for which the common law rights are superseded or; (ii) a term in the standard form which would have covered such common law rights has been deleted by agreement between the parties.

Even where such specific provisions are made in a contract, it may be invalidated by the Unfair Contracts Terms Act (1977). Common law claims are resorted to where the conditions to be complied with in making a claim under the express provisions of a contract are deemed to be onerous.

3.2.3 *Quantum Merit* Claims

A quantum merit claim provides remedy for a party who has carried out work for which no price has been agreed or where a new contract has been substituted for the original contract and payment is sought for the value of work done under the substituted contract.

3.2.4 *Ex gratia* Awards

An *ex gratia* (out of kindness) award or claim is one which the employer is not legally bound to meet. For instance, an employer may find it less costly to make this award to a contractor to save him from insolvency where the cost of completing the work in the event of liquidation or bankruptcy would be more than the amount of the *ex gratia* payment.

Irrespective of the categorisation in law, claims in practical terms stem from on or more of the following [58]:

- unforeseen physical conditions;
- supply of information and drawings;
- variations and valuations;
- delays and disruptions caused by the above.

Generally, contractors will claim for an extension of time and, when entitled, makes a claim for additional expenditure where applicable [64]. Many writers on this subject suggest that, the process of preparing claims is time consuming and expensive [65, 3, 4]. According to Alkass *et al* [58], this is the result of the varied and often *ad hoc* nature of the sources of information that the claims analyst has to deal with in preparing an accurate claim report. It is estimated that it takes several months and costs large sums of money in consultation fees [63, 4].

It is evident that, any claim for remedy within the context of the construction contract thus has two aspects to it. First, is the need to establish the monetary value of the remedy and second, establishing the validity or basis of the claim under the contract [3]. These basic issues were researched in a preliminary study of case law to evaluate their extent and nature.

3.3.0 Basic Issues Common In Claims and Disputes

Case law reports and judgements [61] were studied. The cases related to contractual claims were examined as a preliminary research activity to identify the basic issues which the courts were asked to examine and settle. A majority of the disputes (53%) arose under the JCT terms. This confirms its wide use in the construction industry as suggested by the industry survey commissioned by the Joint Contracts Tribunal established [1].

The cases were categorised under seven basic issues. Table 3.1 is the summary the frequency of occurrence of each basic issue.

Table 3.1 : Basic Issues In Claims and Disputes

Category of Issue	Percentage of cases
Interpretation of contractual provisions	92%
Valuation of Work and damages	56%
Delays and Extensions of time	28%
Compliance with notice requirements	25%
Incorporation of documents	4%
Substantiation of damages	7%
Other issues	32%

3.3.1 Interpretation of Contractual Provisions

The study suggests that in 92% of litigation resulting from claims made under contractual provisions, the courts were asked to interpret the rights and obligations under the terms expressly set out in conditions of contract. This indicates that, amongst other factors responsible for the high incidence of litigation in the construction industry the inability to appreciate terms of contract is an important one.

The study also suggests that, the courts in general, rely on well established principles of contract law to interpret contractual provisions. For example, where the provisions of contract could not be shown to be onerous to any of the parties in dispute within the context of the Unfair Trade Terms Act [63] and similar legislation governing commercial contracts, the parties were generally held to fulfil their obligations. An illustration of this interpretation is the case of *Redpath Dorman Long Ltd. v. Tarmac Construction Ltd.* [64].

Redpath were subcontractors under the "blue form" with an arbitration clause. A set-off clause provided that:

> *"The contractor shall be entitled to set-off against any money..... otherwise due under the sub-contract the amount of any claim for loss and/or expense which has actually been incurred by the contractor by reason of any breach of, or failure to observe the provisions of this sub-contract by the subcontractor, provided: (a) the amount set-off has been quantified in detail and with reasonable accuracy ; and (b) the contractor has given the sub-contractor notice in writing specifying his intention to set-off the amount quantified.......and the grounds on which such set-off is claimed to be made."*

Tarmac admitted that by November 1978, £209,204 had been certified by the architect as due to *Redpath*, but claimed a set-off against this sum of the same amount as damages for delay and non-performance. *Tarmac* calculated that it had incurred additional cost for inefficient utilisation of labour and plant equivalent to 17 weeks by 8th November at £76,500, and £3476 because efficient re-deployment of resources was impossible, a total of £79,976. Redpath sued for the full amount. The court held that the terms of the clause did not allow any claim for loss or expense which might occur in the future. *Redpath* were entitled to the full amount minus the loss and expense with interest until payment, but the action relating to the quantified sum would be stayed and the dispute referred to arbitration.

3.3.2 Valuation of Work and Damages

Contract terms provide a mechanism for valuing work which differ in terms of quantity and costs from the original estimates such as those issued under variation instructions (§§ 3.4.0). Also, where the actions of the employer or his agents results in additional expenditure by the contractor these have to be valued and the contract sum adjusted accordingly [71, 72]. The quantity surveyor would be required to value variations in the works and make the necessary adjustment to the contract sum for the prime costs and provisional sums, or for claims permitted by the contract, or under fluctuation clauses so as to enable the final certificate to be issued [72, 73, 74].

In 56% of the cases reviewed, disputes relating to the validity of these valuations under variation provisions was among the issues contested. In all instances, the dispute has been about the acceptability of prices or rates used to calculate the value of work or claims. In addition, these disputes raised questions regarding the nature of records kept on the costs of work items put by project participants and the monitoring procedures set out in contracts.

3.3.3 Delays and Extensions of Time

The truth is that a majority of projects overrun the stipulated completion dates. This can be attributed to the nature the uncertainties surrounding building and civil engineering projects. As such most standard forms of contract permit the extension of completion date where certain stated events under the control of or beyond the employer for example strikes and inclement weather result in delays to completion [59]. Alternatively, where the event causing delay is one in the control of the contractor he suffers damages usually liquidated as stated in the contract [59, 78, 79].

Disputes of this nature often present some difficulty. This is because as in many instances several events some under the control of the employer may occur at the same time. Here, the problem becomes one of relating each event to its effect on the cost and duration of the project if any. The courts in these instances rely on expert evidence to assist in evaluating updated master programmes very often used to monitor projects [78]. Reliance is also placed on the opinion of construction experts to establish the extent of the effect of each event on the project. This review suggests that on poorly managed projects the likelihood of disputes are greater since the necessary documentation used to monitor the project will most likely be absent [78].

3.3.4 Compliance and Substantiation of Damages

Most construction contracts require parties follow certain laid down claims notification procedures. In fact, some provisions stipulate time limits for compliance in certain situations [77]. The contractor for example, is required to give written notice within a reasonable time of certain events occurring which he considers entitle him to claim additional payment under the JCT provisions. The purpose of such provisions is to enable the employer to consider its financial consequences[2].

Special attention to contemporary records may be essential either to refute or calculate the amount claims with precision [78]. In most of the cases, the courts were willing to interpret these obligations as conditions precedent to a claim and thus any failure comply may deprive a claimant of all remedy. Whereas the JCT conditions for example, clause 26 requires the contractor to make an application to the architect " *as soon as it has become, or should reasonably have become, apparent to him.....*", the ICE conditions stipulate in most instances a specific time frame. The significant proportion of cases relating to compliance and substantiation of damages suggests a lack of appreciation of the provisions for communicating changes in project circumstances.

This research is therefore set in a background that attempts to curb the high incidence of claims and disputes. The rest of this chapter reviews the contractual principles relating to claims in order to further clarify the importance of this research.

3.4.0 Basic Legal Principles

Claims by parties to construction contract often relate to one or more of the following matters [79]:

- contract documentation;
- the execution of works;
- matters relating to payment;
- delay and disruption;
- default by one party.

According to Wallace [91], financial claims by contractors against employers resulting from a combination of the above matters fall under one of two principal legal sources of remedy. These are:

1. Damages for breaches of contract by the employer. These include, breaches affecting the performance of the contract which nevertheless proceed to completion, breaches resulting in the termination of contract before completion and breaches of employer's payment obligations.

2. Additional payment due under one or other contractual provisions. This includes sums due as a result of variations to works, measurement on unit price contracts, compensation for changed physical conditions, variation of price, lack of instructions and/or information and other compensatory provisions.

3.4.1 Damages for breaches of contract

The principle applied in the assessment for damages for breaches of contract is logically and clearly stated in an early judicial *dictum* stated by Viscount Haldane in the case of *British Westinghouse v. Underground Electric Railway of London* [75]. His Lordship stated then that:

> *"The quantum of damage is a question of fact, and the only guidance that the law can give is to lay down the general principles which afford at all times but scanty assistance in dealing with particular cases. The Judges who give guidance to juries in these cases have necessarily to look at their special character; and to mould for the purposes of different kinds of claim, the expression of the general principles which apply to them, and this apt to give rise to an appearance of ambiguity. Subject to these observations, I think there are certain broad principles which are quite well settled. The first is that, as far as possible, he who has proved breach of a bargain to supply what he has contracted to get is to be placed, as far as money can do it, in as good a situation as if the contract had been performed."*

This principle was earlier espoused in the first and second rules in the judgement in *Hadley v. Baxendale* [76]. The principle implies that the award any claim for damages depends on the factual matrix of the case. These facts influence the courts perception of the extent of the damage and naturally the monetary value of the award. Significantly, any ward is only intended to reimburse a claimant as far as money can for the loss of opportunity to conduct his business in the ordinary course of events.

3.4.3 Additional payment under contractual provisions

Delays, disruption and changes in the scope of construction works occur even on the most well planned projects. According to the findings of Semple and Hartman's survey [19], delay and disruption have a major impact on the expenditure of the employer or income of the contractor. Understandably, this recognition led to the inclusion of elaborate provisions intended to define the scope of disruption and delay claims for which contractors are entitled and liquidated damages provisions for employers.

The provisions in most standard forms of contract as a matter of principle employ the concept of price, not cost, when providing for the valuation of additional payments [74]. This means that the unit-prices or, in a lump sum contracts the prices in a Schedule of Rates or Bills of Quantity (BoQ), are usually required, either directly or indirectly, as a basis for determining the value of such additional payments. The valuation clauses in the JCT family of standard contract forms (for example clause 13 of the JCT80) which lays out the terms for valuing variations gives credence to the price concept. The intention of such provisions is to use the prices which in fixed priced contracts, are regarded as related to the estimated level of prices at the likely time of performance in question [74]. On variable priced contracts, this is based on earlier price levels, but corrected through the operation of price variation or fluctuations clauses as in clause 37 of JCT80.

An example of the application of the price concept is the Canadian case of *Cana Construction Co. Ltd. v. The Queen* [77]. *Cana Construction* were main contractors for the construction of a new postal terminal at Edmonton, Alberta. The contract provided for the main contractor to enter into a subcontract for the installation of the mail handling equipment with a sub-contractor selected by the Crown. The successful contractor was required by the contract, not to include the supply and installation of the equipment but include a figure for overheads, supervision and profit. On this installation, this was estimated as cost of $1,150,000. However, the plaintiffs were instructed to enter a sub-contract at a price of $2,078,543. *Cana Construction* requested a variation order for $2,171,398. This figure was the sub-contract tender plus 10% of the difference between the sub-contract tender and tender price to cover profits and overheads. The crown declined to pay. The court held that the contractor was entitled to a payment for profits and overheads calculated on the real sub-contract price and not on the tender figure, which was based on an estimate.

All disputes situations are not by any means as straight forward. For example, not all variation orders are made in good time or can be absorbed without difficulty in the contractors original programme of works without some effect on his critical path. Such variations may include changes to site access and altered quantities. As a consequence, where they significantly affect the economics of the project or an activity most standard provisions do permit a departure from the concept of price.

Departing from the price concept requires the cost concept to be superimposed upon the applicable contract prices, namely as an addition to (or subtraction from) the prices in the

BoQ or Schedule of Rates. The result is a comparison of the actual costs of the items, as originally priced for, against its actual cost as carried out. This requires that where the priced items in the BoQ or Schedule are high or profitable, then the resulting adjusted price to the special characteristics or effect of particular event, say variation will also be high or profitable and vice versa.

3.5.0 Provisions to reimburse the contractor

Most of the widely used standard forms for the reasons stated above (§§**3.1.1** and **3.1.2**) contain express provisions permitting the contractor payment for extra cost where specific events delay or disrupt the contractor's progress. The provisions of the more common standard forms are briefly reviewed in the following sections.

3.5.1 The JCT80 Provisions

The provisions allowing the contractor to seek reimbursement for additional costs incurred as a result of the actions of the employer or his agents is set out in clause 26. The contractor is required to make a written application to the Architect where "*...the regular progress of the works or any part thereof has been or is likely to be materially affected by any one or more of the matters referred to in clause 26.2*". The matters referred to in addition to the deferment of possession of site include:

- late receipt of instructions, drawings, details or levels from the Architect (26.2.1);

- the opening up for inspection of any work, or the testing of any work, materials or goods (26.2.2);
- any discrepancy in or divergence between the contract drawings and the contract bills (26.2.3);
- the execution of work outside the contract by the employer or any persons engaged by him under clause 29 of the contract;
- the supply or non-supply of materials which the employer has undertaken to make available (26.2.4.2);
- the postponement of all or part of the works under the instruction of the architect (26.2.5);
- failure by the employer to give access to the site, where the employer has undertaken to so provide (26.2.6);
- variations or instructions on the expenditure of provisional sums under the variation clause (26.2.7).

To assist in the evaluation of the additional expenditure, the contractor is required by clause 26.1.1 to provide any detailed information the architect through the Quantity Surveyor (QS) might request for the ascertainment of the loss and or expense [86]. The contractual machinery of payment through interim certificates is then employed to reimburse the contractor.

3.5.2 IFC84

The IFC84 follows closely the wording of JCT80. It however, includes additional provision to deal with certain kinds of disruption to the main contractor which may arise out of contract relating to named sub-contractors [79].

3.5.3 GC/Works/1

The provisions of GC/Works/1, clause 46(1) entitles the contractor to reimbursement for events listed in the clause which results in " *the regular progress of the works or any part of them being materially disrupted or prolonged*". The contractor however, should have "*properly and directly incurred any expense.*" The relevant events include delay in providing drawings or other information and delays by other contractors.

Although claims under this clause can only be made where there is "*disruption or prolongation*", expenses resulting from compliance with the Project Manager's instructions can be made under clause 42 and 43 of the contract. Claims resulting from unforeseen ground conditions are subject to the provisions of clause 7.

3.5.4 ICE conditions

Under the ICE conditions, a contractual claim may be made to engineer at any time during the currency of the contract and up to three months after the date of issue of the defects correction certificate [80]. The majority of claims specified in the contract relate to adverse physical conditions and artificial obstructions (clause 12), extensions of time (clause 44), delays arising out of clauses 7, 12, 13, 14, 27, 31 40, 42 and 59, ordered variations (clause 51) and valuations and rate fixing (clause 52) [81].

3.3.5 The NEC conditions

The grounds for making claims are referred to as "compensating events" under core clause 60.1. These compensating events are essentially the same as those listed in JCT80 clause 26 (§§**3.2.1**) save the provision which specifies that Project Managers notification of a correction to an assumptions about the nature of a compensating event is a ground for claims (compensating event 17). In addition to these grounds, the provisions of the NEC elaborates on the terms for claims for changes to the physical conditions of a site. The contract in clause in 60.2 also provides that, the contractor is assumed to have taken into account the site information provided, any publicly available information referred to in the contract document and other information which an experienced contractor is reasonably expected to obtain.

3.5.6 The Claims Application procedure

Despite the varied language applied by each standard form, all these provisions have a common theme. Although the emphasis varies, all require the contractor to follow specific procedures. Generally, the process includes three key aspects:

- the contractor informing the supervising agent (Architect/Engineer/Project Manager) of the likely expenditure of additional resources;
- the contractor should specify the relevant matter or event responsible for the additional cost;
- the contractor should provide as much detailed information as may be requested to enable the extra costs to be estimated.

Although these claims are referred to differently depending on the contract (the JCT referees to such claims as loss and/or expense, the ICE as costs), in this thesis, they will be referred hereafter as loss and expense for simplicity.

3.5.7 Meaning of Loss and expense

The following cases explain what this widely used phrase means in practice with respect to quantification and justification of claims.

Wraight Ltd. -v- P.H.& T(Holdings) Ltd. [82]

The contractors (*Wraight Ltd.*) under the JCT63 terms agreed to construct certain properties. Soon after commencement of works, unsuitable soil conditions were encountered and the supervising Architect properly directed that the work should be suspended. This suspension went beyond the period stated in the appendix of the contract. The contractor consequently determined his employment under clause 26(1)(c)(iv) (the equivalent of JCT80 clause 28.1.3). The employer did not dispute that he was bound to pay the contractor an amount as direct expenditure on starting the work, but disputed the contractor's claim for profit which they should have earned had the project been completed.

This case is an example of the first category of legal financial claims (§§ **3.4.0**) and the fact that loss of business profit was claimable in law.

Judgement: The court ruled that the words "*direct loss and/or damage*" must be given the same meaning as they would have in the case of breach of contract. The loss of profit was direct and natural consequence of the determination of the contract.

Saint Line -v- Richardson, Westgarth & Co. Ltd. [83]

In a contract to supply engines for a ship a relevant clause stated that the defendants will not be liable " *in any case........... extend to any indirect or consequential damages or claims whatsoever.*" The manufacturers of the ship engines, *Richardson, Westgarth & Co.* breached the contract and the owners brought action claiming damages for:

- loss of profit for the time during which they were deprived of the use of the ship;
- expenses of wages, stores etc.; and
- fees paid to experts for superintendent.

Judgement: All the heads of claim were recoverable as direct damage and were not excluded by the clause. This case implies that it is not possible to use exclusion clauses to prevent claims for loss and expense where there is factual evidence of a parties breach and its financial consequences.

Tate & Lyle Food & Distribution Ltd. -v- Greater London Council [84]

The GLC constructed two new piers in the river Thames, causing heavy silt deposits which interfered with the plaintiffs use of their jetties upstream. As a result heavy dredging costs were incurred by the plaintiffs. The engineers who designed the piers were found to have adopted an inappropriate design. The plaintiffs therefore claimed for direct cost of dredging and cost of managerial supervision.

Judgement: The court ruled that in principle *Tate & Lyle* could properly recover damages for direct cost and for managerial and supervisory expenses directly attributable to the removal of silt. The claim for management and supervisory costs however, failed because, *Tate & Lyle* could not prove their loss by proper records or otherwise. It was not permissible the court held, to allow a percentage of other items of the claim as costs for management and supervision as *Tate & Lyle* had attempted to do.

F.G. Minter Ltd. -v- Welsh Health Technical Services Organisation (WHTSO) [95]
The plaintiffs were the main contractors on a hospital construction project executed under the JCT63 terms. Numerous variations were made by the defendants which affected the progress of the works as a whole and a nominated sub-contractor's work. Claims were made and paid under clause 11(6) and 24(1)(a) (now JCT80 clause 26.1). *Minter* claimed that, finance charges which they incurred as a result of being stood out of their money were " *direct loss and expense*." *WHTSO* argued that these charges were not "*direct*" and were a claim for interest.

Judgement: The loss was "direct". *Minter* were entitled to recover the finance charges incurred.

3.6.0 Permissible heads of claim

The judgements in the cases summarised in section **3.5.0** and the literature reviewed, clearly make the following heads of claims admissible under provisions that seek to reimburse the contractor for loss and expense. These are:

- direct site costs or on-site costs or on-site overheads,
- head office overheads;
- loss of profit;
- inflation of cost;
- interest and finance charges and ;
- cost of disruption.

3.6.1 On-site overheads

On-site overheads, cover all those site costs which are not directly related to particular items of work. This relates to, *inter alia*, supervisory and administrative staff engaged upon the site, site huts, telephones, electricity, rates, welfare and sanitary facilities, lighting and heating. In building contracts, these items are normally priced in the preliminaries section of the BoQ.

Where the Contractor keeps proper records the additional costs due to on-site overheads are readily ascertainable and claimable as 'direct loss and/or expense' under the JCT forms and as costs incurred under the appropriate clause of the ICE Contract. Powell-Smith and Sims [2] suggest that, in cases of claims for reimbursement of additional on-site overheads arising from delayed completion, the fact that ordinarily the Contractor would be running down his site establishment towards the end of the contract should be recognised in the assessment of the amount of reimbursement. In such cases, they argue, taking the costs from the date when the work would have been completed to the date of actual completion as the reimbursable amount would be unfair to the Contractor.

Generally, the Quantity Surveyor knows how the Contractor has made up his site overheads in the tender calculations. It is therefore not unreasonable for such information to be requested from the contractor.

However, it is notable that in most of the standard forms, the contractor has no contractual obligation to provide such information. This has consequences for claims management (See Chapter Four, §4.2.0). Where a contractor withholds the relevant details of his tender the Quantity Surveyor would justified if he adopts an 'average' approach [87]. This involves using breakdowns of site overheads from relevant past experience or records of similar jobs.

Most on-site overheads are time-related. For this reason, it is often necessary to analyse the contractor's programme to establish they are affected by the event from which the claim has arisen. For example, delays usually means the continued employment of site agent for that period. The extra amount claimable in respect of the agent would be the cost of employing him per period multiplied by the period of the delay [2].

3.6.2 Head office overheads

Head office overheads refer to costs incurred in maintaining and running a head office, with its attendant costs. Spence Geddes [87] lists these items of costs as follows: (i) salaries paid to the head office staff, director's fees, attendants and cleaners; (ii) the rentals of the offices, including rates and taxes and depreciation of the office furniture and effects; (iii) incidental insurance, fire and insurance; (iv) heat, light power, and fuel; (v) stationery, books, postage and telephone charges; (vi) auditors' fees; (vii) staff cars; (vi) interest on working capital, loans, bank charges and retention moneys.

The ease with which this element of a claim can be quantified and justified depends upon the method used by the contractor in pricing head office overheads. The most common methods includes [2, 24]:

- a percentage addition to the direct cost (or prime cost) to Bill items at tender to allow for head office overheads separately;
- as a percentage addition to the direct cost of Bill items to cover both head office overheads and profit;
- as method-related charges [93].

Sometimes, a single mark-up on the direct costs may also be made out to cover head office overheads, profits, charges of risks, and sometimes discounts on materials purchases and sub-contracts [88].

The entitlement of the Contractor to claims for payment of head office overheads has been the subject of much debate [92]. Two separate questions are at issue in this debate: (i) whether the particular contract allows this type of claim, i.e., contractual justification; and (ii) how the claim should be quantified.

3.6.2.1 Legal Justification

Some forms of contract expressly entitle the contractor to recover extra head office overheads arising from defined causes. For example, the ICE Conditions expressly includes overheads both on and off the site in any "extra cost" recoverable by the

Contractor (clause 52.4). The JCT standard forms are not so clear on the subject. As a result a long standing debate as to whether extra head office overheads are part of the "*direct loss and/or expense*" to which the Contractor is entitled under Clause 26 has been going on.

Case law suggests that head office overheads are covered by the "*direct loss and/or expense* ". In *Wraight Ltd.*[82] (§3.2.7) it was held that under the JCT 63 provisions, the phrase 'direct loss and/or expense' means that the sums recoverable are equivalent to damages at common law. If this interpretation is correct then, the head office element of claims submitted under the JCT contracts are justified. The logic is that, the construction project is expected to contribute towards the running cost of the company head office. The prolongation or disruption of a project has the effect of reducing its contribution to monthly turnover. In addition, where the project is disrupted or delayed intervention from head office is often necessary.

Thus, the basis of head office overheads recovery can be said to arise naturally from such disruption. This argument makes head office overheads claimable under the principles of established in *Hadley v. Baxendale* [76].

3.6.2.2 Quantification of head office overheads

Five methods for calculating the amount recoverable for head office overheads can be identified from literature. These are, maintenance of contemporary records, the Hudson formula method, the Emden formula method, Eichleay formula method and using actual cost records.

Maintenance of records

Head office overheads are sometimes split into direct head office overheads and general head office overheads. Direct head office overheads are those which relate to a particular contract, such as managerial time used in buying materials, hiring plant, and updating programmes. General head office overheads are those which do not relate to any particular contract and include rates, lighting, heating, telephone, tendering and stationery. Powell-Smith and Sims [2] advise that those two elements of overhead costs should be kept separate and that contractors should require their staff to keep time records of work on particular contracts.

Where the contractor has good records they can be used to determine the additional cost of direct head office involvement in the running of a particular contract. However, care has to be exercised to avoid double recovery through the use of formulae [2].

It is very common for contractors to use percentages and formulae discussed in the following sections to quantify total head office overheads and profits recoverable without differentiating between direct and general overheads.

The Hudson formula

The formula derives its name from the reference book in which it first appeared, Hudson's Building and Engineering Contracts [91]. The basis of the calculation is that the contractor will have allowed in his bid a contribution to his head office costs. This allowance is either made as, or is equivalent to a percentage of the contract sum. This amount is than reduced to a weekly sum by division by the contract period i.e.

$$\text{Head office overhead} = \frac{\text{Head office/profit percentage}}{100} \times \frac{\text{Contract Sum}}{\text{Contract Period}} \times \text{Period}$$

The use of the Hudson's formula has been criticised on a number of grounds [90, 92]:

1. The method assumes that the overhead/profit percentage budgeted for by the Contractor in his prices was in fact capable of being earned by him elsewhere had he been free to leave the delayed contract at the proper time. In reality, it could happen that the contractor had underestimated his direct costs and thus rendered the percentage for overheads/profit unachievable. Also there could be a change of market conditions for work necessitating a change of mark-ups;

2. The linking of profit and overhead together in this way clouds issues because recoverability of head office overhead and of profit may not always coincide. Usually recoverability of overheads is accepted with only the quantum to be substantiated;

3. The formula ignores the effects of variations and fluctuations on the Contract Sum. The pricing of variations would normally include an allowance for overheads and profit by the application of rates in the Contract Bills or under the 'fair valuation' rule. The valuation of this excess due to variations in this way leads to some double recovery of overheads and profits. Fluctuations which are not included in the Contract Sum have the effect of reducing the percentage of overheads/profit recovery on actual total costs;

4. Using the formula as it stands would, it appears, result in profit being added to the profit already in the Contract Sum. For the formula to work effectively in this respect *the term should equal Contract Sum less overheads/profit;*

5. The formula ignores the Contractor's opportunity, and therefore general duty, to deploy his resources elsewhere during a period of delay, to the extent reasonably possible in the circumstances. This might mean a management decision to put some of his head office staff on other work.

The Emden formula

This alternative formula reported in *Emden's Building Contracts and Practice* [93], estimates overhead and profit as:

(head office percentage/100) X (Contract Sum / Contract Period) X Period of delay

The head office percentage is arrived at by dividing the total overheads cost and profit of the organisation as a whole by the total turnover for each financial year. The Hudson formula includes the percentage for head office overheads and profit in the contract sum whereas Emden uses the percentage for the company during the year which matters giving rise to the claim occurred.

Eichleay Formula

This formula gained it name from the American case of *Eichleay Corporation* v. *The Federal Government* [94] which resulted from the construction of a nuclear facility near Pittsburgh, Pennsylvania in the USA. In their claim *Eichleay Corporation* (hence the name) developed the formula for calculating head office overheads. There are three stages to in this calculation:

Step 1: Overhead that can be allocated to the contract = (Contract Sum/ Turnover) X (Total overhead incurred during the contract for the financial year)

Step 2: Overhead allocated per day = (Overhead allocated / Actual days of contract performance)

Step 3:

Unabsorbed overhead = (Overhead allocated per day) * (Number of days of compensable delay)

Using actual cost records

An alternative to the formulae approach is the ascertainment of head office cost incurred as a result of the matter giving rise to the claim. In the *Tate and Lyle* [84], the plaintiff was awarded a sum of £10,000 representing additional dredging costs and £540,000 as the extra cost of dredging caused by the siltation of the bed of the Thames river for which the defendants were found liable. An additional claim was made in respect of managerial time involved in dealing with the dredging required and rearrangement of berthing schedules. This head of claim was quantified by adding 2.5% to the remainder of the claim, the plaintiff offering no evidence in support. The court declined to uphold the claim.

Clearly, the plaintiff is entitled to be paid head office costs if he can offer sufficient evidence in support of the costs to satisfy a judge or arbitrator.

3.6.2.3 Formula versus Cost

Should head office overhead be calculated using formulae or actual cost records? It appears that the formula approach would most probably be accepted if the contractor can demonstrate that his resources could have been readily employed elsewhere. These criticisms aside, Knowles [71] argues that ascertaining this head of claim using formulae represents a loss to the contractor.

Given the arguments against the use of formulae, the only alternative and certainly the least contentious is for the contractor to offer the necessary evidence for the claim to be established on the basis of the actual cost involved. The contractor however is not entitled to use both methods and be paid twice.

The use of the formulae methods have gained wide use following the judgement in the Canadian case of *Ellis-Don Ltd -v- The Parking Authority of Toronto* [96] and the subsequent UK case of *J.F Finnegan Ltd. -v- Sheffield City Council* [97]. In the latter case the court was required to decide on what, if any allowance for head office overheads and profit should be made on the plaintiffs claim. The court allowed a weekly sum calculated by reference to the tender figure.

This judgement which apparently approved the use of Hudson's formula did not deal with very important proofs which must precede its use as identified in the *Ellis-Don* case i.e. it must be shown that:

- the profit included in the contract price was capable of being earned elsewhere at the time of delay [98];
- the profit was reasonable and;
- there was work of the same level of profitability available in the period of delay.

The last of these proofs in the opinion of Kirsh [99] was difficult to attain in a period of recession. Indeed, as the judge in the *Peak Construction* case pointed out, what amounted to the proper sum (head office overheads and profit) depends on evidence such as:

- what the site organisation consisted of;
- what part of the head office is being referred to and what they were doing at the material time;
- analysis of yearly turnover including the period claimed for so that proper assessment can be made.

Providing details which satisfy the above criteria is the least the law requires in order to grant or accept the quantum for this head of claim.

3.6.4 Disruption and loss of Productivity

The contractor is often compelled to adopt inefficient working in other to perform his obligation under contract. This generally, expresses itself in the form of higher labour and plant expenditure relative to work done [100]. This can result in a particular labour force or plant being engaged for a longer period, or the recruitment of additional labour and plant to avoid or recover from a delay (i.e. acceleration). The problem can be made worse on poorly designed works which require substantial redesign during construction. Although accepted as a head of claim, how it should quantified and substantiated is a difficult matter.

This difficulty is highlighted in the recent case of *Alfred MacAlpine Humberoak v. McDermott International Inc.* [101] where the court had to establish the appropriate method of estimating the disruption caused by a multitude of variation orders from the defendants.

The plaintiffs expert, the court pointed out, erred when calculating that, if one man was working for one day on a particular variation order, then the whole contract was held up for that day. Secondly, he assumed that a whole work force planned for an activity was engaged continuously on that activity from the day they started until the day the activity was finished. A technique often adopted by contractors to quantify alleged disruption.

The court accepted that the defendants method of examining each variation and trying establish its impact on the time taken to complete each activity and resource required. Thus relying on actual time spent and resource used as compared to what levels would have been used without the disrupting event. This is the method advocated by Tricky [24] for quantifying disruption as opposed to the common practice of using general percentages.

3.6.5 Interest and finance charges

A clear statement of the acceptability of interest and finance charges was established in the case of *Res & Kirkby -v- Swansea City Council* [102]. Here the court held among other issues that:

> *"interest charged on a Bank borrowing.to fund the contract was a "direct loss"; it was secondary loss which continued until the primary loss was paid. Its character did not change to become "indirect loss" at the time of practical completion."*

This was confirmed in *Laser borne Ltd. -v- Moron Big Ltd* [103] where the court based its quantum on the last audited accounts of the plaintiffs. This was also accepted in the principle in *Ogilvie Builders Ltd. -v- Glasgow City Council District Council* [104].

3.7.0 Cost of preparing claims

A whole industry of consultancies have emerged in recent years specialising in assisting in the preparation, presentation and evaluation of claims. Where such specialised consultants are employed their services in themselves constitute considerable cost to contractors and clients. However, the question of whether such costs can be an acceptable head of claim is still to be addressed. Trickey [24] suggests that where special research is necessary to prepare and submit a claim, and the effort involved is over and above that reasonably anticipated at the time preparing the tender, the cost of preparing would be recoverable. This view is supported at least in case law by the decision in *Piper Double Glazing v.*

David Caulfield [105] and *James Knowles Group v. Topek Holdings and Topek Roofing* [106].

3.8.0 Importance of contemporary records

The law takes a very tough stance on what will constitute proof in order to establish the quantum of any head of claim. The case of *Barclays -v- Fairclough Building* [107] provides such a lesson. In that case, a county court judge disregarded the builder's time sheets and awarded a sum to the plaintiffs based on a "*proper charge*" assessed by an expert witness who was a Quantity Surveyor. The Court of Appeal allowed an appeal and held that the price be based on the time sheets presented by the plaintiff. Entitling the contractor to be paid on a day work basis.

In the earlier cited case of *Tate & Lyle* [84], Justice Forbes rejected the method chosen by the plaintiffs to quantify the cost of managerial and supervisory cost. Commenting on the plaintiffs inability to present contemporary records he said that:

> *"....But modern office arrangements permits the recording of the time spent by managerial staff on particular projects. I do not believe that it would have been impossible for the plaintiffs to have kept some record to show the extent to which there routine was disturbed by the necessity for continual dredging sessions."*

Clearly, for all the heads of claims identified, the courts will prefer their establishment through the use of contemporary records except in exceptional cases. The use of formulae, in the view of Justice Forbes amounted to asking the courts to speculate on the likely damage suffered by claimants which was inherently unacceptable to the courts.

3.9.0 Summary

The legal background to construction contract claims has been reviewed in this Chapter. Judicial opinion on the acceptability of the common heads of claims and their quantification has been established.

Two main approaches to the estimation of the various heads of claim can be identified. The formula approach which has been widely criticised in some aspects and the use of contemporary records. The latter is clearly preferred but the maintenance of such records require the use of additional resource. It remains to be seen how the choice of method of quantification actually affects claims settlement in general. However, it is apparent that claims are a recognised and essential part of the normal management of any construction project.

CHAPTER FOUR

THE CURRENT CONTRACTUAL FRAMEWORK FOR CLAIMS MANAGEMENT

4.1.0 Introduction

In Chapter Three, the general legal principles and arguments that form the basis for the settlement of claims were reviewed. The demands of the alternative methods of quantifying claims suggested that, the requirements for claims quantification and presentation can vary from contract to contract. However, the need for good project management practice appears to be central in order that parties can arrive at a satisfactory settlement. Specifically, the ability to produce relevant documents to substantiate every claim was stressed.

To some extent, Kangari [28] made this point when he concluded after a survey of arbitrators that, claims settlement is speeded up considerably by the presence or implementation of efficient project documentation. His assertion corroborates the Wood Report [5] which pointed out more than two decades ago that, one way of ensuring that projects are adequately documented is through the provisions of contract and its associated documents.

In this chapter, the requirements of the major forms of contract with respect to the documentation of construction projects is examined to determine whether they provide an adequate contractual framework for managing claims. The object is to identify the areas where these contracts are deficient as a basis for making proposals for ensuring good claims management practice.

In the rest of this chapter the provisions of the main standard forms of contract are examined under three main sections: project activity documentation, preparation and updating of programmes and claims documentation. These are the main methods of recording the progress of works, changes in resource usage which form the bases for formulating and evaluating all claims irrespective of their origin.

4.2.0 Project Activity Documentation

The only major standard form of contract which expressly specifies the records that the contractor should maintain is the GC\WORKS\1. The contract requires the contractor under Clause 34 to provide the Supervising Officer(Contract Administrator) on a daily basis, with a "*distribution return of the number and description of work people employed on the Works.*" In Clause 44(3)(d) the contractor is required to keep " *wage books, time-sheets, books of account and other documents*" as part of the determination clause.

The other major forms are silent on the subject. However, the provisions on contractors' applications for loss and/or expense incurred as a consequence of specified events suggests that, such records should be maintained. For example, clause 26.1.2 of the JCT80 requires that the contractor, "*in support of his application submit to the Architect upon request such information as should reasonably enable the Architect to form an opinion.*" The subsequent clause 26.1.3, uses the word "*details*" which can be interpreted as meaning the actual resource records from which costs can be calculated.

The ICE6 provides under clause 52(4)b that where a contractor intends to make claims for additional payments other than for variations (under clause 51) or measurements of variations (clause 56(2)), a written notice should be given within 28 days after the happening of events giving rise to the claim. The clause states that "*upon the happening of such events the Contractor shall keep contemporary records necessary to support any claim he may subsequently make.*" Alternatively, the Contractor can be instructed to keep such records which the Engineer can inspect (clause 52 (4) (c)). The copies of the records should be made available by the Contractor when and if the Engineer so instructs.

The NEC makes reference to record under options C (Target with Bills of Quantity), D(Target with Activity Schedule), E(Cost Reimbursement Contract) and F(Management Contract) in clause 52.2 which requires the contractor to keep:(i) accounts of his payments of actual costs; (ii) records which show that payments have been made; (iii) records of communications and calculations relating to assessments of compensating events for sub-contractors and ; (iv) other accounts and records as stated in the works information.

Works information is defined in the contract as information which specifies and describes the works or states any constraints on how the Contractor should execute the works. This also includes documents which the contract data specified is or an instruction given with the contract. The contract under clause 52.3 empowers the Project Manager to inspect these records.

What the reference to "*details*" and "*records*" actually means with regards to contractors' claims submittals is not very clear. Case law however, offers some guidance. Lord Justice Salmon giving judgement in *Peak Construction* [103] case remarked that it was useful for a claimant to "*offer some evidence as to what the site organisation consisted of.*". The

Contractor, this case suggests, has to keep records of a certain level of detail to enable an opinion be formed on his actual costs. Although the prudent contractor may maintain some records, it is conceivable that under these vague terms, records can be withheld as a tactic to gain more from potential claim situation. On the other hand, such records may not be available because many contractors still regard project record keeping as unnecessary contrary to view that they are fundamental to speedy claims settlement [3, 28]. According to many commentators the consequence is that, the preparation and presentation of claims suffer [2, 24, 110]. Disputes over the principle and quantum of claims therefore become more animated since the interpretation of events and allocation of responsibility are left very much to the imagination of the parties [114].

Table 4.1 summarises the requirements for site documentation required by the main standard forms.

Table 4.1: Provisions for site documentation

Form of Contract	Provisions that make reference to records	Express Provision	Documents Mentioned
GC\WORKS\1	34 44(3)(d)	YES	Timesheets Wage Books Books of Account
JCT80	26	NO	-
ICE 6	52(4) -	NO-	
NEC	Clause 52 in Options C, D, E and F	YES	Accounts of payments Receipts for payments correspondence

A possible explanation of the lax requirements to document construction projects is that, theese provisions may have been drafted in such a way as to prevent the Engineer/Architect (A/E) from using such provisions to interfere directly with how a Contractor manages his project. However, from a claims and disputes resolution perspective this has proved to be counter-productive. It has from cursory review of case law served only to make claims settlement at project level difficult because very often the records required to substantiate claims may be non-existent or could be withheld.

4.3.0 Preparing and Updating Programmes of Work

Scheduling is the determination of the timing of construction activities which follows logically from the planning process [115]. Many forms of schedules exist, from bar charts to critical path method schedules. Each has its advantages and disadvantages. Each with its appropriate applications.

The primary advantage a bar chart is its simplicity [115]. This simplicity has led to its wide acceptance as an effective planning and scheduling tool for some projects. Bar charts are simple to read and interpret and can communicate in a straight forward manner the results of network schedules. However, a bar chart cannot depict the intricacies of multiple activity interaction. This inherent limitation reduces the effectiveness and accuracy of bar charts in projects involving a large number of activities.

The simplicity and inherent limitation of bar charts also makes them an attractive tool for some types of construction, such as highway or pipeline construction where the contractor must constantly adjust schedules to overcome weather-related problems [115]. For instance, when high soil moisture content makes compassion inefficient, equipment may be moved to another location where soil conditions may be better. Weather-related shifts cannot be planned and shown on the schedule, but a bar chart does not need to be revised when they occur, because it shows little information about sequence and relationships of project activities anyway [110]. Bar charts therefore give contractors who perform repetitious work more flexibility and does not require constant revision to match actual sequence.

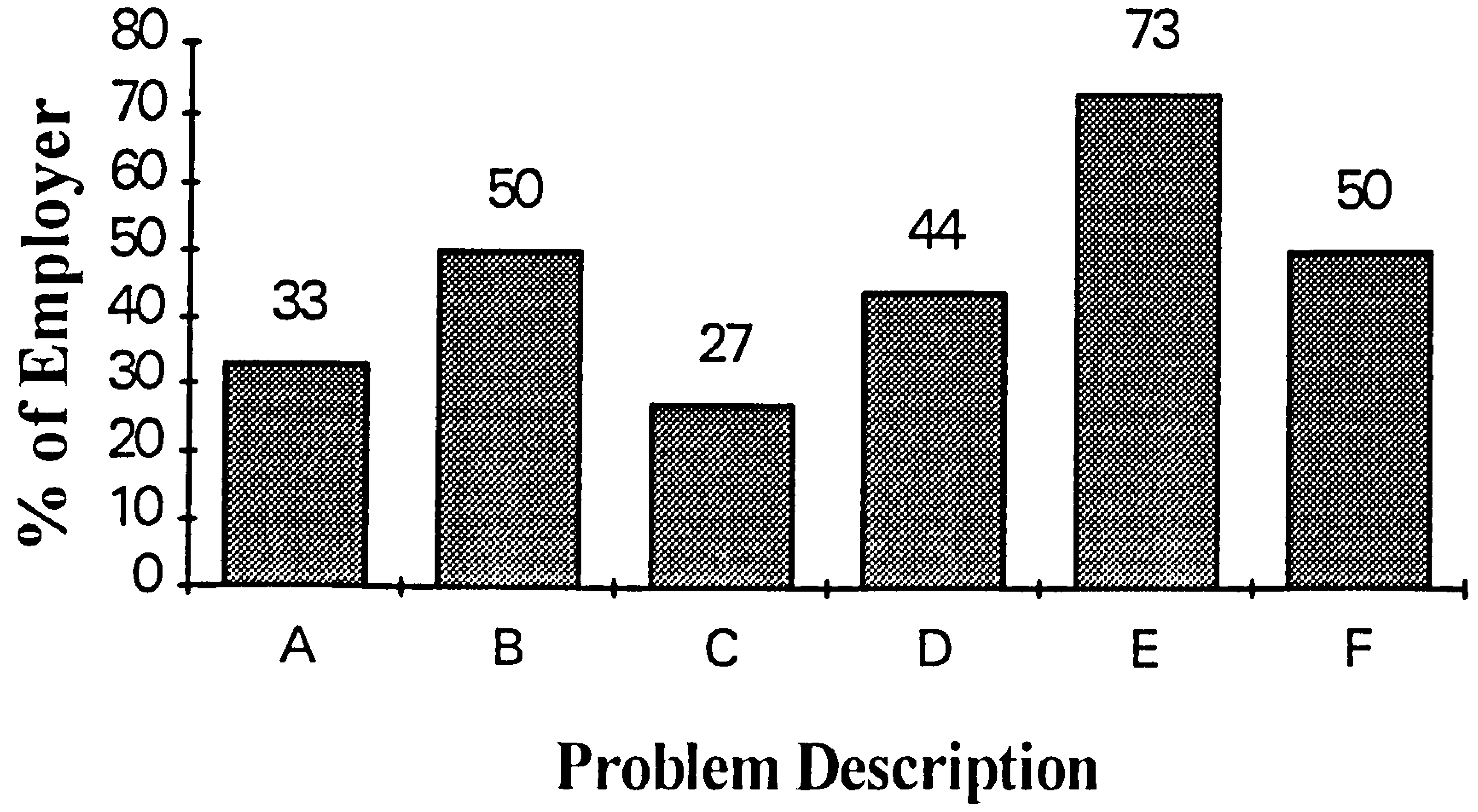
The primary disadvantage of bar charts relates to their preparation. A bar chart is difficult to prepare accurately when there are continuous relationships between many activities and if multiple-activity interaction is required to complete the project. They can also be prepared all too easily encouraging unrealistic schedules.

According to Callahan, Queckenbush and Rowings [115], there is also the tendency to work backwards when preparing bar charts. Knowing a project's date of completion, the scheduler may plot the chart representing the final activity so that it ends at the time the project must be completed. Other activity bars are then spread to cover the time available, adjusting for a bar on the basis of start and end dates of previous activities. Thus there is a tendency to produce bar chart schedules that contain arbitrary, if not unrealistic activity starting and finishing times, rather than anticipate realistic sequences, constraints and durations. According to Mills [116], this the reason why contractors who use bar charts have a higher proportion of delayed completion than those who use critical path methods.

In addition to these limitations, when bar charts are cost loaded and used as a basis for monthly payments to the contractor, it is easy to "shift" costs to earlier scheduled activities to improve the contractor's cash flow. This techniques is known as front-end loading. Although this is just good business sense for the contractor, it not in the interest of the employer .

The main disadvantage of bar charts is that, the logic the planner used in developing it is not obvious. To understand the impact of changes, this logic must be known. This shortcoming and others have led to the development of more complex approaches such network scheduling using the critical path method (CPM). This approach enables the planner to incorporate a wide variety of activities to depict their interrelationships graphically.

Few people involved in the construction industry today will dispute the need for construction project schedules. Figure 4.1 shows an extract from an American survey of 448 employers involved in construction projects carried out in 1983 [117]. The report indicated that on most construction projects in excess of $10 million, a third were sometimes completed behind schedule. Only half of the employers reported that their contractors used the Critical Path Method(CPM) schedules on their projects. However, employers whose contractors usually use CPM programme of work appear to be less susceptible to delay. Only 27% of the employers whose contractors usually used CPM programmes said that their construction projects were usually or sometimes behind schedule, while 44% of the employers whose contractors sometimes or hardly ever use it experience delays.



A. Projects completed behind schedule B. Contractors who use CPM

C. Contractors who use CPM and Project late D. Contractor who do not use CPM and Project late

E. Poor schedules cause cost overrun F. Project late and Project Dispute

Figure 4.1: CPM use versus on-time project completion(*Source*: Opinions of Building Owners on the Construction Industry, A Report to Wagner-Hohns-Inglis, Inc., Opinions Research Division, Fleishman Hillard, Inc., September 1983)

A much more significant finding of this survey within the context of claims and disputes is that delayed projects and disputes are closely related. More than half of the employers who experience delay had been involved in arbitration or litigation. Of the respondents, 73% attributed delays and cost overruns to poor scheduling or poor scheduling techniques

Another survey of 800 construction industry participants reported that over half the owners believed that poor contract administration to be most threatening factor in contractual relations [118]. Participants in this survey included contractors, designers, sub-contractors, construction managers and employers. To improve contract administration, 83% stated they had or intended to install schedule control systems.

These surveys do not only demonstrate the significance of planning in construction and the importance of having properly prepared schedules to control and manage time but also their use may reduce the probability of protracted disputes and litigation [115, 25, 119].

In practice, there are two mutually complementary ways in which the advantages of programmes (particularly CPM schedules) can be exploited to manage claims and disputes better. The first, is by drawing up an adequately detailed specification for preparation and maintenance of programmes or schedules. The second, is by including an appropriate contractual provision that necessitates the use of such programmes.

In relation to above issues, the major standard forms are now riefly examined to determine how they incorporate the programme of works into construction contracts and its consequence for claims preparation and evaluation in particular.

4.3.1 Provisions on contractors programme

JCT80

The JCT80 makes reference to the contractor's programme in clause 5.3 in the following terms:

> *5.3.1.2 the Contractor without charge to the Employer shall provide the Architect (unless he shall have been previously so*

provided) with 2 copies of his master programme for the execution of the Works and within 14 days of any decision by the Architect under clause 25.3.1 or 33.1.3 with copies of any amendments and revisions to take account of that decision.

5.3.2 Nothing contained in this descriptive schedules or other like documents referred to in clause 5.3.1.1(nor in the master programme for the execution of the Works or any amendments to that programme or revision therein referred to in clause 5.3.1.2) shall impose any obligation beyond those imposed by the Contract Documents.

Considering this clause in its totality, it implies that, the contractors' programme is not a contractual document. The status of the programme of works under the JCT terms is summed up by Trickey [24] in page 52 when he explains that:

"....it is difficult to see why it should be, as nothing would be achieved if it were except perhaps that it would make it easier to identify in that it would signed by the parties to the contract."

The programme Trickey continued "*is a statement of good faith*" which could form the basis for the Architect to estimate time extensions.

The position of the JCT provisions is illustrated by the case of *Pigott Foundations Ltd. v. Shepherd Construction* [120] which centred around the standard form for domestic sub-contractors DOM/1 specifically clauses 11.1 and 11.8.

Clause 11.1 provides:

> *The sub-contractor shall carry out and complete the sub-contract in xx weeks and reasonably in accordance with the progress of the works.*

Clause 11.8 provides:

> *The sub-contractor shall use constantly his best endeavours to prevent delays in the progress of the sub-contract works or any part thereof however caused to prevent delays resulting in the completion of the sub-contract works being delayed beyond the period of completion and the sub-contractor shall do all that may be reasonably required to the satisfaction of the Architect and the contractor to proceed with the sub-contract works.*

Piggott Foundations [120] were engaged under DOM/1 to do piling for the defendants within a period of eight weeks on a 14-storey building in Coventry, West Midlands. Far from completing in eight weeks, *Pigott* were two months late. They claimed that the delay was caused by events beyond their control and that they were entitled to time extension. A preliminary issue was tried to consider whether the sub-contractor was liable to the main contractor for breach of the terms of the sub-contract. The court held that:

The words "*progress of works*" were directed to requiring the sub-contractor to carry out his work in a manner as would not unreasonably interfere with the actual carrying out of any other works which can be conveniently carried out at the same time. The words did not require the sub-contractor to plan his sub-contract work so as to either fit in with any scheme of work of the main contractor or finish any part of the sub-contract works by a particular date so as to enable the main contractor to proceed with other parts of the works.

Clause 11.8 did not assist the main contractor.

There was no obligation on the sub-contractor to carry out his work in any particular order or at any specific rate of progress. Clause 11.8 meant that the sub-contractor was to prevent delay in the progress of the sub-contract work only so far as the delays would result in the sub-contract overrunning the eight-week period. It does not exclude or modify the general building and engineering contracts principle that, in the absence of indications to the contrary, a contractor is entitled to plan and perform as he pleases, provided he finishes by the time fixed in the contract.

The problem this interpretation of the JCT terms raises is that, in practice as this case illustrates, there will tend to be disagreement about the extent of delays and disruptions and which party was responsible on projects involving several parties. Clearly, without any legal obligation to work within an agreed programme it is impossible to prevent serious disputes. The tenor of the JCT terms therefore works against the effective use of programmes of work as means of evaluating the performance of all parties. In this regard Powell-Smith [121] argues that, the decicion in Pigott [120] defeats tha purpose of the programme.

The ICE clause 14

The ICE 6th clause 14(a) requires that "*within 21 days after the award of the Contract the Contractor shall submit to the Engineer for his acceptance a programme showing the order in which he proposes to carry out the Works having regard to the provisions of Clause 42(1).*" The Contractor is required at the same time to give in " *writing for the* *information of the Engineer a general description of the arrangements and methods of construction which the Contractor proposes to adopt for the carrying out of the Works*".

The clause also sets out the terms for revising the programme (clause 14(4)) to ensure that "*at any time the actual progress*" conforms with the accepted programme. It also entitles the engineer to " *require the contractor to produce a revised programme showing such modifications to the original programme as may be necessary to ensure completion of the works or any section within the time for completion.*"

Clause 14 (a) (1) clearly leaves the level of detail of the programme to the discretion to the contractor, leaving the door open to the possibility for highly contentious claims for delays to the contractors programme. Although much more explicit on what is termed the programme, in many ways these provisions goes no further than the JCT80 requirements. Examining the status of programmes in respect of delays and time extensions under the ICE terms, Powell-Smith and Stephenson [122] explained that:

> *"the mere happening of an event confers no entitlement to an extension of the contact period. The test to be applied is whether the event is such as may entitle the Contractor to an extension of time. The Contractor's actual progress must be delayed. The planned or programmed progress is irrelevant. The contractor's obligation under the provisions of contract is to complete within the stated time. The Engineers approval of the programme showing the sequence and time scale in which the Contractor proposes to carry out the works under clause 14(1) does not affect the position."*

Although a sound argument in law, this leaves the issue of how the actual progress will be documented under the contract unanswered providing a fertile ground for disputes over the granting of extensions of time.

In addition, by omitting to specify what type of programmes (scheduling technique) and information it should contain, the question of how changes in progress will be evaluated is left un-addressed. For example, if a contractor presents his programme in the form of a bar chart (with the acquiescence of the Engineer) how would the parties evaluate delays beyond the contract period?. Or how would such a programme take account of the provision of design information by various design consultants and instructions from the engineer himself which delays or disrupts the contractors progress? The reality is that the ICE terms do not go beyond the JCT provisions save its emphasis on the need to ensure that actual progress is documented.

The only argument that can be made in support these vague terms is that, specifications drawn with the contract could provide the parties with a clearer statement of the nature of the programme. In any case the curious lack of sanctions in these provisions defeats their purpose. This perception is illustrated by the arguments made in *Glenlion Construction Ltd. v. The Guinness Trust* [123]. Although this case centred on the interpretation of a term of the specifications for preparing and updating the programmes of works, this was a fundamental argument about ownership of float. The contractors' had programmed to complete the works before completion date specified in the contract but the Architect failed to issue necessary instructions. This resulted in the contractor overrunning his planned completion date successfully argued that his obligation was only to ensure completion by the date specified in the conditions of contract. Mugurian [124] laments that, this decision permits the Employer to effectively obstruct the Contractor in the performance of his obligations under the contract.

This judgement also implies that, although the contractor can programme to complete the completion date set in the contract should he prevented from doing so by the employer or his agents default he has no chance recouping the cost of deploying additional resources. The employer effectively owns the float a clear disincentive to the contractor. Unfortunately, this concept of project management is enshrined in the standard forms. This fails to satisfy one of the criteria for scheduling construction projects: the ownership of float. Wickwire, Driscoll and Hurlbut [125] and Wishart [126] argue strongly that this must be resolved at project inception to avoid disputes. The collective impact of these provisions is to indirectly remove an incentive to plan and keep to programmes of work.

The NEC

The New Engineering Contract [127] now dubbed the Building and Civil engineering contract takes a slightly difference stance on the issue of programmes of work. This much more proactive form of standard contract under core clause 31 states that the contractor's programme will be rejected if it fails to:

- include the information which the contract requires;
- represent the Contractor's plans realistically;
- show realistic provision for: (i) float and other risk allowances;(ii) health and safety requirements; (iii) other requirements for Works Information or; (iv) the procedure set out in the contract.

The "Accepted Programme" should include : (i) the starting date, possession dates and completion date; (ii) for each operation, a method statement which identifies equipment and other resources which the Contractor plans to use; (iii) planned completion; (iv) the order and timing of operations which the Contractor plans to execute in order to provide the Works and the work the employer and others are responsible or as later agreed with them by the contractor; (v) the dates when the contractor plans to complete the Works in accordance with his programme, including possession of part of the site if later than its possession date, acceptances, plant, material and other things to be provided by the employer and; (vi) other information which the works Information requires the Contractor to show on the Accepted Programme.

These provisions are arguably a much clearer statement of what should constitute a programme of works in practice. Additionally, the unequivocal indication that the programme should incorporate information from other parties as well as the requirement to include floats, and works information contrast with the vague terms of both the ICE and JCT forms. In terms of providing a basis for amicable settlement of claims using detailed programmes of work the NEC is better placed.

However, NEC also fails to provide any sanction for non-compliance and also does not indicate what form the programme should take. From this precepts a detailed bar chart can qualify as an accepted programme although severely limited when it comes to estimating delays, progress and disruptions.

4.3.2 Problems with specifications for programme of works

It may be argued that in order to ensure brevity, the authors of these major construction contracts preferred that the employer uses specifications to ensure that the project has an appropriately detailed programme of works. This leaves each employer with the task of drawing up his own specifications. The consequence this situation can be very expensive. In the case of *Yorkshire Water v. Alfred MacAlpine Ltd* [128] the plaintiffs invited tenders for a tunnel to be constructed for a reservoir which incorporated the ICE conditions(5th) with their own specification for programming which stated that:

> *In addition to the requirement of clause 14 of the conditions of contract, the contractor shall supply with his tender a programme in bar chart or critical path analysis form sufficiently detailed to show that he has taken note of the following requirements and that the estimated rates of progress for each section of the work are realistic in comparison with labour and plant figures entered in the Schedule of Labour, Plant and Sub-contractors.*

The defendants submitted a tender accompanied by a bar chart and method statement which was approved. The method statement had followed the tender documents in providing for the construction of the works upstream. The contractors maintained that in the event it was impossible to do so and after considerable delay, the work proceeded downstream. The contractors contended that they were entitled to a variation order under clause 51(1) of the ICE conditions which was referred to arbitration.

The arbitrator made an interim award in January 1985 on the issue of whether the method statement formed part of the contract and whether it was a term of the contract that the contractors were not entitled to follow the method statement. The court held that:

The method statement was not the programme submitted under clause 14.

The incorporation of the method statement into the contract imposed on the contractors an obligation to follow it save in so far as it was legally or practically impossible to do so *per* Skinner J:

> *"The plaintiff could have kept the programme and methods as the sole responsibility of the contractor under clause 14(1) and the risks would have been the respondents throughout."*

The method statement therefore became a specified method of construction so that if the variation which took place was necessary because of impossibility within clause 13(1) the respondents were entitled to a variation order.

This case demonstrates that specifications for preparing and maintaining a programme of works can be written to achieve one of two goals. First, to encourage the contractor to plan and manage a project or second, impose detailed reporting requirements that permit the employer or contract administrator to schedule the project [115]. However, where this is done there must be shared responsibility to ensure compliance.

Wickwire *et al* [126] provide typical examples in the American context. They cite instances where most standard forms, owners and designers recognising the potential benefits of detailed programmes of work(using the CPM technique) include appropriate specifications along with the conditions of contract. None of the major forms in the UK are accompanied by appropriate specifications for programmes of work. This is a serious deficiency since the terms in specifications can alter the implied terms of contract (see the *Yorkshire Water* case). The effect of the use of bespoke specification therefore has implications which can be equated with the use of non-standard forms of contract in that: (i) the experience of other specifications cannot be brought to bear on subsequent specifications; and (ii) the skill required to formulate these programmes cannot be maintained and (iii) the legal impact on the obligations for all parties cannot to known with any certainty.

Wickwire *et al* [126] also advice that, to achieve the best results from such specifications, several conditions must be satisfied: (i) the programme should be feasible;(ii) the preferred form of programme should be stated;(iii) the number of activities it should contain indicated;(iv) approval procedure should be clear; (v) updating of programme should be mandatory; (vi) cost loading should be required; (vii) float use and reporting specified and; (viii) the circumstances in which major revisions and time extensions should be clearly specified.

Judging from these recommendations, the NEC provisions come closest to incorporating these elements contractually. The main benefits of such specifications in conjunction with provisions of contract it has been argued those with experience of claims and disputes will be to provide a benchmark for evaluating the performance of all parties [119]. Incorporating a requirement to prepare CPM programmes will therefore provide a contractual environment adequate for such an objective evaluation of the performance of all parties is good practice. This would be good practice four main reasons:

- a more effective project performance monitoring is possible;
- the control and speedy assessment of the effect of changes on the time and cost of projects is facilitated;
- the ability to adequately evaluate disrupting and delaying events well before practical completion is made comparatively easier;
- adjudicating contractual disputes relating to performance becomes more objective.

4.3.2.1 Monitoring Performance

The failure to explicitly require the preparation of an appropriately detailed programme as suggested to some extent by the NEC provisions and the requirement of all parties to adhere to such programmes is notably absent from most of the standard forms. The logical result is the difficulty experienced in monitoring performance. This can perpetuate inefficient working, wastage and lack of co-ordination especially where several sub-contractors are involved on the project

4.3.2.3 Assessing time and cost impact of changes to project scope

The primary use of any planning tool is to estimate with some certainty the likely consequence of events on the project in terms of time and cost. Provisions that require periodic update of programmes will first and foremost lead to the taking of remedial action to mitigate the likely impact of certain events on project duration and cost. In this respect, the use of time impact analysis suggested by Wickwire *et al* [125], Alkass *et al* [63] and Callahan *et al* [115] for example, can give early warning signs as to the likely cost of time overruns on specific project activities.

4.3.2.4 Evaluating delay claims

The use of contractor's programme with sufficient details such cost loading, with appropriate responsibility codes, means that it is possible to establish the cause of any delays and/or disruptions quite quickly.

Such programmes, if supported by contemporary records, can be used in disputes to estimate the extent of financial liability using the as-built and as-adjusted programme [12]. In fact it has now become common practice to construct the schedules to demonstrate entitlement to claims although very often based on little or no documentary proof. Recent case law [128, 129] suggest that incorporating these programmes with clear and concise provisions which state their role in resolving issues relating to performance is good practice. This eliminates the time consuming process of reconstructing the construction process very often from inadequate or non-existent records requiring in many instance external expertise.

4.3.2.5 Adjudication disputes

Almost all disputes in construction relate to performance. Although the main bone of contention in many disputes may appear to focus on monetary liability, the underlying issue is often whether the event for which a party is claiming reimbursement could lead to the loss. The adjudication process therefore, hinges on what level of performance was being achieved and how the said event might have affected performance. Take the case of a contractor claiming loss and expense for the delay in the provision of design details by the engineer. It first has to be established when this information was needed and when it was actually available. Setting aside, the issue of reminders to the Engineer it becomes a matter of conjecture where properly updated schedules is not available [124].

4.3.3 Consequence of inadequate provisions and lax specifications

The consequence of inadequate contractual provisions and/or specifications of programmes directly affects contractual relations [130]. This is because most disputes in construction centre predominantly around the responsibility for delays and the extent of the attendant costs. Enhancing the contractual provisions in this respect or alternatively agreeing to model specifications that can provide the basis for improved claims management and in the long run efficient planning of construction projects (see Chapter Twelve).

4.4.0 Claims Documentation

None of the standard forms specify the format to which all claims are required to comply. Where the Employer or his professional advisers have a preferred format this should be suggested to the Contractor. Though the Contractor is not contractually bound to accept it the greater likelihood of expeditious treatment of claims may be enough incentive for the Contractor to co-operate. In any case, Powell-Smith and Sims [2] advise that every claim should be prepared with the possibility of eventual litigation or arbitration in mind. It is therefore advisable that it should be in such a form that it can be readily used for the purpose of formal pleadings.

4.5.0 Summary

The mechanisms set up in the major forms of contract appear to expect the contract administrator to ascertain contractual claims without any indication of what method should be employed. It stands to reason that the combination of the lack of compulsion to keep records coupled with the status of the programmes of work provides a fertile ground for disputes over the extent of employer caused delays on projects and consequently the actual cost to the contractor. The philosophy of completion by any means tacitly endorsed by almost all the standard forms of contract, does not promote good project management and is largely responsible for much of the frustration associated with claims management in the construction industry as well as its reputation for litigation.

There is therefore, a need to put in place the management and contractual framework to improve the situation. Such a contractual framework should ensure adequate documentation of project activities and incorporate well prepared and maintained programmes of work using preferably the CPM technique to remove some of the difficulties associated with the management of claims.

CHAPTER FIVE

DECISION MAKING IN THE CLAIMS MANAGEMENT

5.1.0 Introduction

Decision-making in the administration of construction contracts requires access to information existing in various forms and stored in different locations. The decision maker exercises his professional expertise in the light of all relevant information available to him.

For example, the choice of construction method for the foundation of a building depends on ground investigation reports provided at tender stage, the resources available to the contractor, e.g., earth moving equipment, tradesmen, the contract period and resource output and usage rates. When a decision is made and implemented, it generates additional or modified information which has to be stored and retrieved for yet further decision-making. The successful preparation and evaluation of construction contract claims invariably, entails reviewing these decisions and critically analysing of the associated information. In view of the conditions imposed by the law in formulating claims (Chapter Three), and in spite of the lax provisions for documenting the progress of works (Chapter Four), parties responsible for this increasingly important aspect of the management of construction contracts face two main problems.

Firstly, even on the simplest construction project, the sheer volume and diversity of formats and sources of information which the claims management process requires makes full access and manipulation very difficult. Secondly, such parties must possess adequate expertise not only of the organisational, technical and financial management of construction contracts but also of construction law.

In furtherance of the arguments put forward for investigating the management issues responsible for delays and disputes in settling claims (§§1.3.0), the decision-making process involved in claims management and the associated information requirements are examined in this chapter. This is to identify conceptually, the problems likely to affect claims management practice. These potential areas of difficulty responsible for delays and disputes will then form the bases for the design of the industry-wide survey (Chapter Six), case studies (Chapter Seven) as well as the evaluation of the potential of IT in claims management (Part B).

5.2.0 Decision Making in Claims Management

The review of the principles of claims preparation and evaluation (Chapter Three) suggests that, the claims management process would often go through the following stages:

Stage 1: An event occurs which causes or is likely to cause the contractor to incur loss and/or expense for which he would otherwise not be reimbursed under the contract. The contractor complies with the contractual provisions on what has happened, e.g. giving notices, estimates of likely impact of time and costs, and responds appropriately to the request of the contract administrator for information.

Stage 2: The contractor establishes entitlement to reimbursement with reference to the provisions of contract.

Stage 3 :The contractor quantifies the claim and assembles supporting documentation for submission in the contract administrator.

Stage 4: The contractor draws up the formal claims document with supporting information for presentation to the contract administrator.

In concept, the claims management stages can be broadly categorised under the following headings:

- ensuring compliance with provisions of contract;
- justification of the claim in principle;
- quantification of the claim and;
- claim presentation.

5.2.1 Ensuring compliance

The provisions entitling contractors to claims for additional expenditure often prescribe a procedure to the notification of the supervising agent (A/E) within reasonable time of the occurrence of the specified event (§§3.3.5). Difficulties with compliance can result from several factors, namely:

- the ability to recognise the occurrence of a specified event;
- inadequate understanding of contractual provisions;
- deficient compliance and probably;
- the lack of sanctions for non-compliance.

The first and second factors can be directly correlated to the experience and training of the individual supervising the works on behalf of the contractor. The third typifies a communication problem. For instance, whether a letter sent to an architect constitutes an application depends on its contents. The solution for such problem appears to be in the use of standard letters. Such letters are often kept in the form of template documents in word-processors in practice. However, the inexperienced could face problems in choosing the appropriate letter. In this instance, a simple dialogue with an expert system (Chapter Nine) can for example alleviate this problem.

The problem of the timing of an application is a difficult one in practical terms, for officers in charge to day to day administration of construction projects. Very often, giving such notices are overlooked because of competing problems on site. However, the more experienced contractors adept in the use of project management software overcome this problem by using sophisticated project management tools that trigger the issue of such notices (§§ **8.2.3.1**). The use of such IT tools however, require experience with a particular package and some cost outlay.

5.2.2 Justification of Claims In Principle

Justification of a claim requires the claimant to prove that, under the express provisions of the contract or on a general principle of the law, there is entitlement to the compensation or other remedy being sought.

For example, if a contractor suffers, or stands to suffer, financial loss from the conduct of the employer (owner) or of other parties for whom the employer is responsible for in law, the contractor must identify the contractual provisions which expressly sanctions compensation against the loss suffered. In the absence of such provisions the contractor may still be able to establish entitlement by showing that the conduct of the employer or his agents amounted to a breach of the contract for which damages in the form of the claim are recoverable under the general law of contract. In addition, where compliance with prescribed procedures (§§ **5.2.1**), e.g., making applications for information or giving notices, is a condition precedent to a claim, than the contractor must provide evidence of such compliance. The decision making process involved in justifying a claim is illustrated by Figure 5. 1.

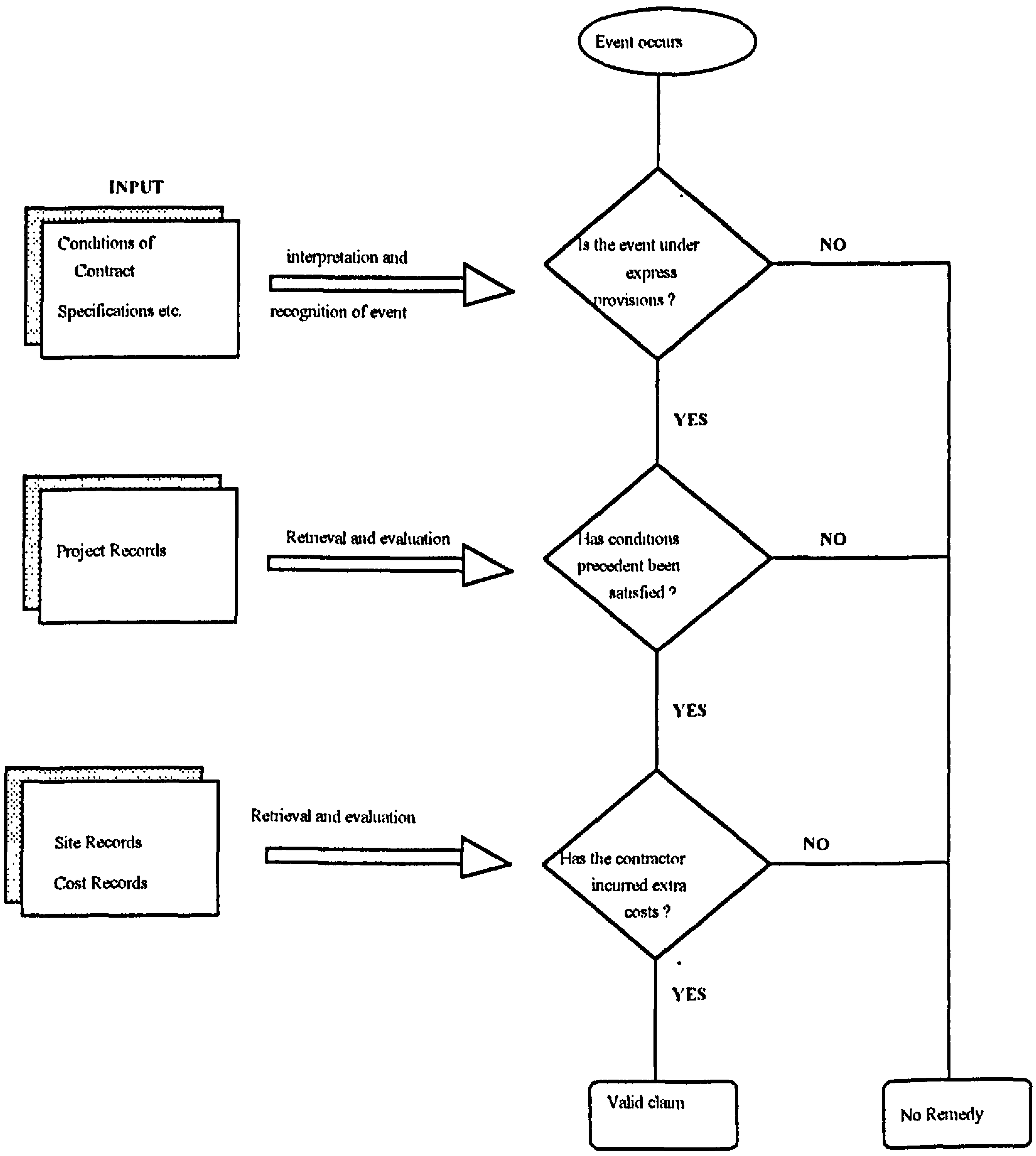


Figure 5.1: Requirements for claims justification

The type of information that will be required at this stage of the claim preparation (Figure 5.1) are in the form of human expertise and text in the form of specifications, the conditions of the contract, correspondence and other communication on the subject matter of the claim. For this reason, the obstacles to success with the claim which arise in the justification process can be attributed to: (i) poor interpretations of terms of contract; (ii) difficulty in accessing contemporary records to demonstrate the impact of the event; and (iii) ensuring that conditions precedent are satisfied. Where this process is not properly undertaken then it likely that the claim will be rejected in principle by the contract administrator. This is in line with the basic requirements of most terms of contract (§§3.3.5). Consequently, the knowledge of the legal framework within which these processes should be undertaken important for success with the claim.

Failure to satisfy the requirements of this stage of the decision making process is evident from the large body of case law which are replete with examples of construction professionals making wrong decisions or failing to comply with contractual provisions simply because of their inadequate understanding of these basic principles.

A further possible complication is that, this decision making process can be handicapped by poor communication in two respects. The first concerns inadequacies, particularly in the areas of channels of, and allocation of responsibilities for communication in the organisation of project site staff. Secondly, written communication may not always state clearly the intention of the party communicating.

For example, a letter from a Contractor to an Architect stating that a certain activity is planned for commencement on a stated date may be disputed by the latter as an application for drawings required for that activity. If a specific application for such drawings is a condition precedent to entitlement to a remedy, then the danger of legal proceedings is considerable. Here, there is considerable scope to use Information Technology (IT), in the form of expert systems (see Chapter Nine) with word processed templates for the various types of correspondence, to minimise these problems. A suitably designed system for example, can provide templates of standard letters for use in various claim situations with the user being clearly directed by the system to add any necessary customising particulars.

5.2.3 Quantifying the Impact of the Event

It is a common temptation among contractors to quantify claims on the basis of the difference between the final account figure (the total amount finally certified by the contract administrator/supervisor as payable to the contractor) and the actual cost of carrying out of the works [124].

The question of the acceptability of such claims has been the subject much litigation in the UK courts for over two decades [131, 140, 132]. In all these instances the courts have repeatedly highlighted the importance of showing a nexus, in both causation and quantum i.e., between the sum claimed and the grounds for recovery of additional payment.

This seemed to have been accepted until the recent Court of Appeal decision in the case of *Mid-Glamorgan County Council v. Devonald Williams and Partners* 29 CLR 84 [114] and *GMTC Tools and Equipment v. Yuasa Warwick Machinery Ltd.* [134]. In the latter case a lower court decision was overturned by LJ Legatt. The learned judge stated then that, a court was not entitled to prescribe the way in which the quantum of damages is pleaded and proved. The plaintiff, he stated, "*should be permitted to formulate their claim as they wish, and not be forced into a straight jacket of the judges or the opponents choosing.*"

This decision has been interpreted by some as a judicial acceptance of the global claims approach [116]. A decision which many commentators are adamant discourages good claims management and fuels disputes because the practice of global claims essentially circumvents the need to provide proper and detailed particulars [136].

The causation problem which these debates are really about, stems from the failure to apportion the total amount claimed to individual causes of compensable loss. If there have been many variations for example, there must be some attempt at linking each variation to a specific component of the claim. To appreciate how daunting this task can be, one only has to bear in mind that there can be hundreds of variations and that in some cases their effects may be so inextricably linked that separation of individual effects would be impracticable within the usual resource levels of each project. Figure 5.2 sets out the logic of this process, which requires three questions to be answered with confidence:

- has the said event led to time and cost overrun?
- can the link between the said event and the time/cost overrun be demonstrated?
- are the detailed cost records available for quantification?

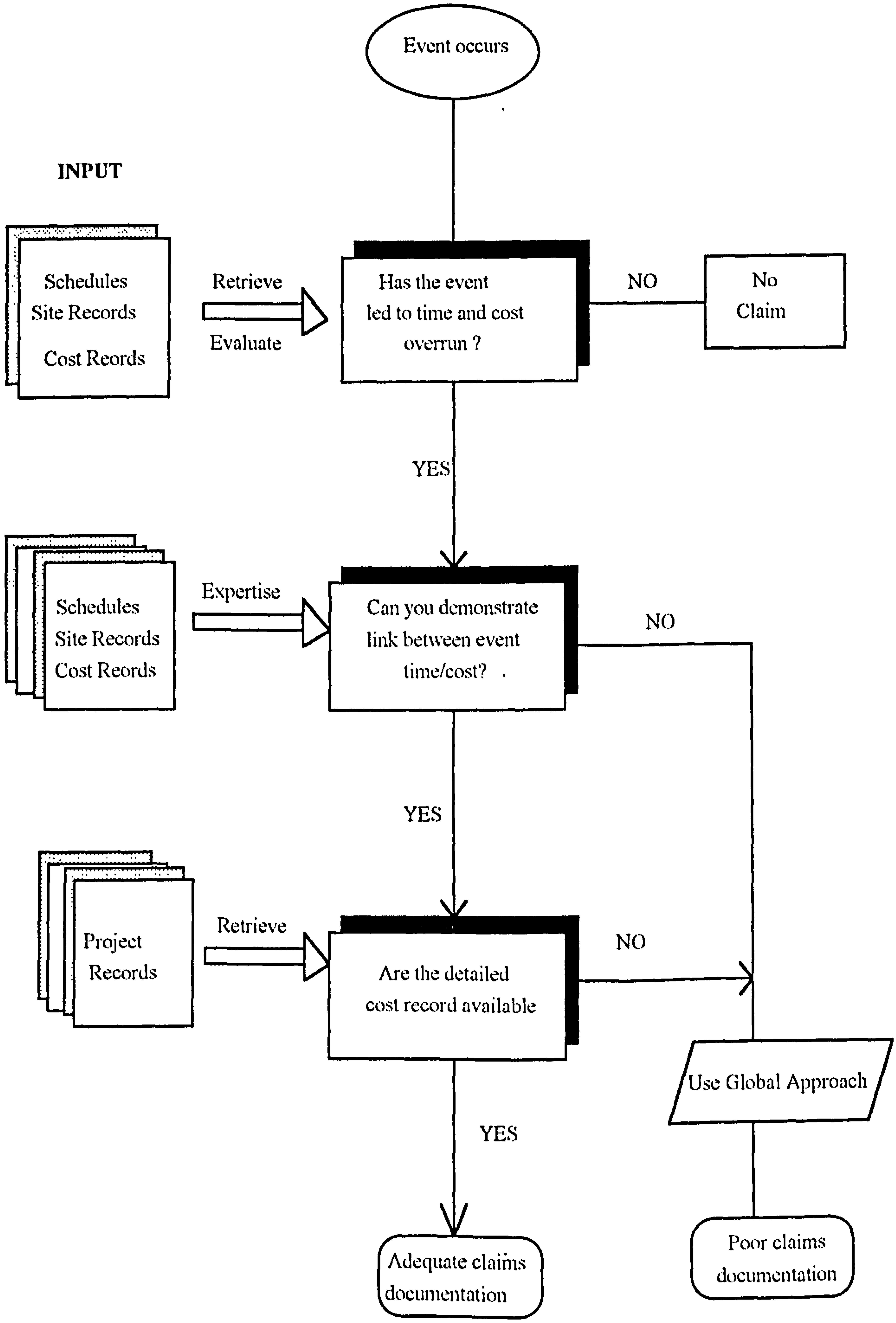


Figure 5.2: Showing causation in claims quantification

In each of these stages, the main problem with the quantification process is in the area of the supporting evidence. As figure 5.2 shows, where projects records are inadequate or inaccessible, it is likely that the global approach will be adopted resulting inevitably to poor claims documentation. For example, if a contractor successfully makes a case in principle for loss of profit and recovery of overhead costs there is the further burden of producing evidence that, but for the cause of the claim, the profit would have been made and the overhead costs recovered. The legal and practical implication of this approach to quantification is discussed in section 5.4.5.

However, the courts have been reluctant to accept the use of general formulae, e.g., profit as a percentage of costs, and Hudson's and Emden formulae, in situation where the loss could been more accurately quantified with proper keeping of relevant records [90]. Commenting on this issue, Powell-Smith and Sims [21] assert that, many claims submitted by contractors are deficient by way of supporting evidence. Valid claims fail for this reason [108]. A point which Schwartskopf *et al* [38] supports arguing that, this was because the process is often treated as an afterthought although there is clear evidence that speedy claims resolution depends on it [30]

As a result of the immense diversity of claims situations, the nature of the back-up evidence will vary from claim to claim. However, it can be concluded from the analysis of the decision making required in justifying and quantifying any claim that the evidence will usually include one or more of the following [27]:

- analysis of the contractor's tender;
- detailed analysis of preliminaries;
- programme/progress schedules;
- cost records;
- correspondence;

- records of site meetings;
- site records;
- analysis of extensions of time granted;
- specifications;
- variation orders;
- drawings;
- photographs.

Like the justification stage (§§5.2.2), the absence of/or lack of access to these documents would mean that the process is delayed or not properly done. To ensure that claims quantification is undertaken satisfactorily, site activity documentation has to be maintained rigorously with a system that is efficient and cost effective. A variety of IT tools already exist which can reduce the time and effort involved in the storage, retrieval and use of these diverse forms of information. These are evaluated in Chapter Eight, Nine and Ten in Part B of this thesis.

5.2.4 The Global Claims Approach

Commenting on the Privy Council's decision in Wharf Properties case [130], the editors of the Building Law Reports defined global claims as:

> *Ones where the connection between the matters complained of and their consequences whether in terms of money or time are not fully spelled out.*

According to Mansour [132], global claims usually manifest themselves in claims for loss of productivity (see Chapter Three), prolongation or delay and disruption. Although this is correct, in Byrne's view [131], this must be understood in the following context:

"Mere prolongation or delay the result of numerous alleged causes, may give rise to a global time extension claim, but it will be rare that a global claim for prolongation costs will be warranted."

This is because, these costs are a function of extra time required to complete the project, whether time related or otherwise [131]. Where delays occur within the project which causes extra expense because of disruption or acceleration, but without extending time required to complete, they are not strictly speaking prolongation costs. These are according to Byrne [131], the stuff of global claim.

Byrne goes on to distinguish two situations of such claims: where the claims are for damages arising from breach of contract and where money and/time is claimed under some provision. An important principle of claims for damages is that ,
provided the breach is established and proved that the loss has flowed directly from that breach, the courts have been reluctant to refuse to award substantiate damages even though the contractor has been unable to estimate precisely the relevant loss.

In addition, as a general principle, a tribunal is not relieved of the burden of estimating damages merely because the task is difficult [134].

In the case of global claims for the adjustment of contract sum or time, the English cases of Crosby [138] and Merton [124], support the proposition that, it is legitimate to make global awards of the sum payable under contract, notwithstanding that:

- the events which give rise to the entitlements are numerous and differ;

- the contractual provisions under which the entitlement arises are various provided that the contractual requirements for each have been satisfied and;
- no specific amount has been proved to flow from one of these events.

However, the courts emphasise that the right to make such awards arises only where [127]:

- the loss and expense attributable to each head of claim cannot be reliably disentangled;
- there is a complex interaction between the consequences of events and;
- the inability to disentangle the consequences of these events is not the result of delay on the part of the Contractor in making the claim

The review of case law suggests that whatever their merits, global claims are not favoured by the courts [140]. The approach therefore available only in an extreme cases where no alternative methods is available.

However, it does seem that a Contractor who can demonstrate that he has suffered loss from a series of compensable events will not be shut out. Especially where the complexities of the project makes it impossible to separately account for the financial and other impacts for the financial and other impacts of these events.

5.2.4 Presentation of Claims

The means by which a claim is presented has a great deal of influence on its ultimate success and the amount at which it is settled [30, 120]. Two basic criteria should be satisfied in presenting claims. First, the claims presentation should reflect a cogent and intelligible explanation of why factors or events for which the other party is responsible gave rise to increased costs. Second, the document itself must look and actually be impressive.

These are important according to Wickwire *et al* [120] because, the individuals who make the final decisions about settlement or non-entitlement of the claim frequently have little knowledge of the actual history of the projects . Although it may be argued that, claims are not settled by the sheer weight of presentation, executives may be swayed by the appearance of a comprehensive presentation. The claim documentation should therefore, not only be impressive but also be an explanation of the increased costs, grounded in the facts and job records in order to improve the chances of speedy settlement [136].

There is always a substantial risk in a detailed claim presentation because of the likelihood of attacks on the veracity of job records. Nonetheless, it is strongly suggested that the most progress can be made in resolving disputes by full disclosure [112, 12, 4]. The alternative, which the current contractual position (Chapter Four) appears to encourage is the presentation of a vague document which generally alleges that certain events had given rise to additional cost without detailing how. This research suggests that, this approach to claims presentation (Chapter Six) does not facilitate speedy resolution. What it does is to initiate a cycle of negotiations or requests for information. Thus after each party exhausts its patience results in lengthy and expensive formal arbitration or litigation.

If a decision is made to utilise a detailed claims presentation, Wood [3], Powell-Smith and Sims [2] and Wickwire *et al* [120] suggests the following rules for preparing the claims submissions:

1. The submission should present a complete package with all the necessary supporting data so that it can be used in a subsequent trial as the basis for proving the claim with little or no extra work.

2. The presentation should offer a complete, accurate and truthful narrative about the conditions encountered on the project.

3. The presentation should admit and take into account problems that are the contractors' responsibility and that has a significant effect on the project.

4. The submission should reflect pricing that is commensurate with rates quoted in the original tender.

The common format for claims involves the following sections : (i) introduction; (ii) narrative of claim; (iii) summary of claim; (iv) appendices.

The introduction contains an outline of the contract including the following, a brief description of the facility to be built, contract sum, commencement date, date of completion and form of contract.

The "Narrative of Claim" contains the following particulars of the claim: events giving rise to the claim, contractual terms relied upon, compliance to date with contractual requirements on claim including references to relevant correspondence and a statement of total claim entitlement.

The "Summary of Claim" section contains a summary of the claim under some or all of the following heads(§§ **3.4.0**): (i) on-site overheads; (ii) head office overheads; (iii) profit; (iv) interest/finance charges; (v) inflation; (vi) costs of disruption; (vii) cost of preparing claims.

Reference may be made to detailed calculations in other sections. The Summary of Claim may also be present in the form of a Scott's Schedule, a type of document used for pleadings in construction contract litigation and arbitration named after a former senior judge. The function of such a Schedule is to set out the claim so clearly that the parties concerned are able to see easily what is being claimed and for what.

The contractor starts the preparation of the Schedule. He then submits them to the contracts administrator, usually an architect in building contracts and a civil engineer in works of civil engineering construction, who goes through it indicating by appropriate comments or other annotation on he employer's position on each element of the claim. Both parties, and the arbitrator/judge where the claims ends up as dispute, are therefore able to see the areas of contention upon which time and effort should be concentrated. Presenting a claim as a schedule can save time at subsequent legal proceedings [141]. Figure 5.3 shows the typical format of Scott's Schedule.

REFERENCE NO.	BASIS OF CLAIM	CONTRACTOR'S		ARCHITECTS		ARBITRATOR'S/JUDGES COMMENTS
		Comments	Cost	Comments	Cost	
A	**Regular progress being disrupted by the late supply of foundation details drawings**		£2,000.00	Rates used in the contractor's quantification are excessively high	£1,500.00	
A1	Cost of disruption is detailed in Appendix A					
A2	Cost of contract-period over-run by 6 weeks @ £5,000 /week	Notice to refer to arbitration if quantification is rejected	£30,000.00	Claim entitlement accepted in principle but the use of Hudson formula is unacceptable. Claim must be supported with actual cost records		
B	**Exceptional rain and snow during the periods stated in appendix B**					
B1	Cost of contract period over-run by 4 weeks @ £5,000.0/week as per build-up in appendix A		£20,000.00	This delay is not compensable under the contract	£ NIL	

Figure 5.3: A typical format of Scott's Schedule

5.3.0 The Conceptual Model of The Claims Management Process

The decision-making processes in claims management and their associated information requirements is summarised by Figure 5.4. The potential bottlenecks to claims preparation identified from the evaluation of decision making process discussed so far are tabulated in Table 5.1.

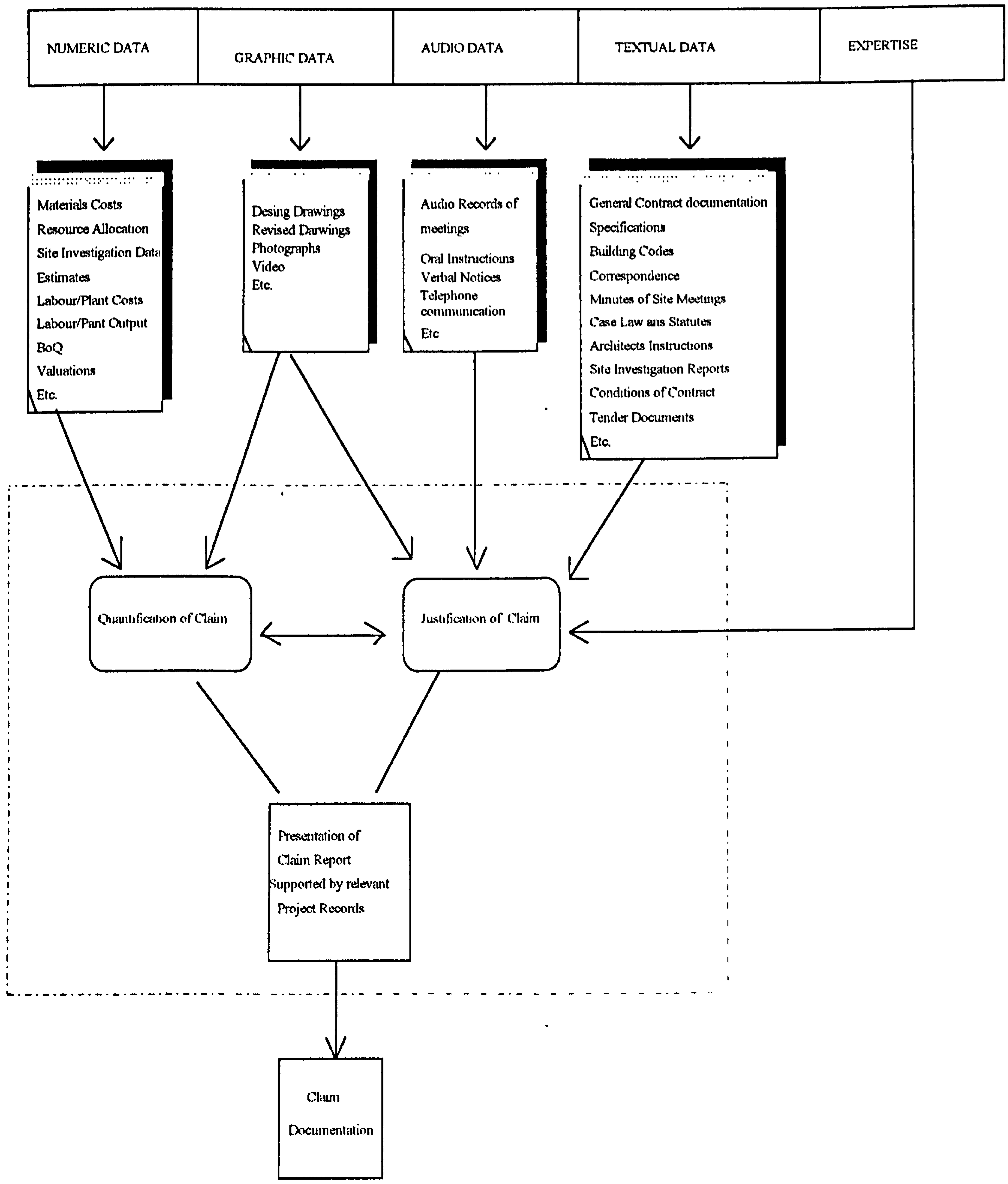


Figure 5.4: The conceptual model for claims management

Table 5.1: Potential problem areas in claims management

Stage of Claims Preparation	Potential Problems
Recognition of events	1. Ability to recognise the occurrence of event 2. Inadequate understanding of contractual provisions 3. Deficient compliance
Justification of claim	1. Lack of understanding of contract 2. Non-compliance 3. Poor communication
Quantification of claim	1. Lack of expertise 2. Lack of /or poor records 3. Choice of method of quantification
Presentation of claim	1. Lack of expertise 2. Poor records

It is concluded from this analysis that, from the contractors' perspective the following can delay or prevent him from properly undertaking the decision making process: the retrieval of claims relevant information, difficulties with quantification, assembling the claims document, identifying the sources of claims-relevant information, interpretation of the contract (expertise), justifying the claims (expertise) and responding to requests for further information.

For the employer and his consultants, the likely reasons for rejecting claims in view of the problems areas outlined above could be one or more of the following: (i) justification of the claim in principle; (ii) inadequate information; (iii) poor or inappropriate methods of quantification; (iv) inappropriate allocation of responsibility for increased costs; (v) non-compliance and; (vi) lack of breakdown of the claim by causes (showing cause and effect).

For all the parties concerned, there has to be the expertise to evaluate and prepare the claim and generally support the claim. These issues were investigated through an industry survey (Chapter Six) and case studies (Chapter Seven).

5.4.0 Summary

Success with a construction contract claim demands that it is justified, quantified as accurately as possible and properly presented to the employer's contract administrator. The analysis of the decision-making processes involved in these tasks indicates that the information requirements entail the handling of data in a variety of formats: text, numeric, audio, graphical and human expertise.

Information management or specifically good document management is therefore central to improving productivity in the performance of these tasks and improved quality of decision-making. In this chapter the case has been made for the development of a system capable of enabling access as well as documenting the construction process. The realisation of such a system requires further research and development in a number of related areas. Particularly, an awareness of the importance of claims management through changes to project management culture which can facilitate the utilisation of Information Technology tools available.

CHAPTER SIX

INTERPRETATION OF POSTAL SURVEY

6.1.0 Introduction

This chapter discusses the results of the postal survey and interviews carried out to identify the main problems associated with claims management. Two separate questionnaires were used, one for the contractors and another for consultants. The questionnaire (shown in Appendix 9) was based on the review of the principles of claim preparation and evaluation (Chapter Three), the impact of the contractual framework on claims resolution (Chapter Four) and the analysis of the decision making process (Chapter Five).

The chapter reports the findings of this survey through a discussion of the results of responses obtained fron contractors and consultants respectively.

6.2.0 Contractors Response

Of two hundred questionnaires sent out to UK contractors, 69 were returned, with 61 completed properly, (a response rate of about 32%). The breakdown of the broad categories of respondents, in terms of specialisation and turnover, is shown by Tables 6.1 and 6.2, respectively.

Table 6.1: Category of Responding Contractors

Category of Contractor	% of Respondents
Building Only	47
Civil Engineering Only	17
Building and Civil Engineering	34
Others	2

The smaller construction companies with turnover below £10 million were least represented. Over 80% of the responses were from firms which may be described as medium to large. Since this category of contractors are more likely to be involved in large and complex projects, the response gives some corroborative evidence for the commonly held view that claims are a problem on larger projects.

Table 6.2: Grouping of Contractors by annual turnover

Annual Turnover (millions)	% of Respondents
Less than £5	2.2
£5 - £10	2.2
£10 - £25	13.3
£25 - £50	31.2
£50 - £100	24.4
Over £100	26.7

6.3.0 Consultants Response

Two hundred questionnaires were sent to the three main categories of construction consultants: Architects, Civil engineers and Quantity surveyors. Analysis of the questionnaires returned showed that, 19.1% of the architects, 30.9% of the Civil/Structural Engineers and 40.1% of the Quantity Surveyors responded. An overall response rate of about 27%. Table 6.3 shows the summary of the response received. The lowest response rate came from the Architects (Table 6.3). The Quantity Surveyors were the most enthusiastic in their response.

Table 6.3 : Category of Responding Consultants

Type of consultant	% of respondents
Architects	19.1
Civil Engineers	30.9
Quantity Surveyors	40.1
Multi-disciplinary	9.9

6.4.0 DISCUSSION OF FINDINGS (Contractors Survey)

6.4.1 Responsibility for claims preparation

The preparation and evaluation of claims require some effort and skill on the part of the contractor (Chapter Five). The level of skill and experience applied to the claims management function can determine the success or failure of the claim. It is therefore important to determine whether the task of preparing claims is specifically assigned or performed on an *ad-hoc* basis. This should put the problem of the quality of claims documentation into perspective and also provide some indication of where resources for training should be directed.

Contractors were therefore asked to indicate, on a scale of 0 - 10 (where 0 represented no involvement and 10 total involvement), the involvement of various categories of project staff with claims preparation. The analysis of responses is shown in Table 6.4.

Table 6.4: Level of Involvement of Contractors' Project Staff in Claims Preparation

Staff	Mean Rank	Rank Order
Project Manager	4.86	3
Project Quantity Surveyor	6.32	1
Head Office-based QS	5.64	2
Site Planning Manager/Agent	4.05	4
Claims Surveyor	2.05	7
External Claims Consultants	2.36	6
Others involved	2.73	5
W	Significance	
0.67	0.00	

The order of ranks suggests that, the contractors' project Quantity Surveyor (QS), the Head Office Quantity Surveyor and the Project Manager play the most significant role in claims preparation. The high and significant value of concordance ($W = 0.67$) for the rankings confirms this.

From this response, it appears that the QS's knowledge of the costing of works and its monitoring is used in the preparation of claims. The exact role of other project team members, such as the Project Manager and Site Planner/Agent, cannot be established by looking at their ranking. However, that they play a subsidiary role in the preparation and evaluation of contractors claims is beyond doubt.

The low ranking of the Claims Surveyor has two main implications. Either claims preparation is not as yet regarded as a specialised project management function requiring the assignment of specific personnel in most construction firms, or, they do in fact exist but most firms are reluctant to use the title for fear of being branded as "*claims conscious*". The higher ranking of others (which includes Commercial Managers and Internal Legal Advisors) may be some confirmation of the latter interpretation. From the order of ranks, it also appears that internal preparation of claims is favoured over the use of external claims consultants.

It can be inferred that the quality of claims documentation depends very much on the experience and skill of QS whose primary role is : (i) to price changes; (ii) to prepare periodic valuations of work in progress for payment on account; (iii) to seek and vet quotations from prospective suppliers and sub-contractors; and (iv) to monitor budgetary performance. Further inteviews indicated that, the demands of these roles results in the QS overlooking or postponing claims submissions until after project completion. The case studies and interviews confirmed unequivocally that in most cases, fully detailed claims submittals are not made until the project is substantially complete. One way of getting round this problem would be to assign this function, as a primary role, to a member of the project team. This officer could then be assisting in monitoring the project and ensuring that adequate records are kept. The advantage of such an arrangement is that, the project team member so assigned will be well versed in the day to day running of the projects and thus better placed to evaluate the implications of site events than others. This arrangement could help overcome the problem of lack of expertise identified as essential for good claims management (§§5.3.0).

6.4.2 Time involved in preparing claims

Claims preparation takes time. In order to overcome the problem of contractors leaving claims till project completion, the aspects of claims preparation that delay or hinder the process must be identified for the design of appropriate remedial strategies. Some of the factors and aspects of claims preparation were identified in Chapter Five (§§**5.3.0**) in the conceptual examination of the process.

With this in mind, contractors were asked to rate eight aspects of the claims preparation process in terms of the time involved. The analysis of their responses summarised in Table 6.5. Their response suggests that, the most time consuming aspects of claims preparation are: preparing the claims documents, identifying relevant information, claims quantification, claim justification and retrieval of information, in that order. Archiving project information takes the least time. This indicates that, this task is not accorded the importance it deserves because casual archiving is likely to result in insufficiently accessible records long after project staff have dispersed. This finding supports the position argued in Chapter One (§§**1.3.0**) that management problems associated with claims are a serious and continuing problem that deserved further investigation.

Table 6.5: Time involved in aspects of claims preparation

Aspect of claim preparation	Mean Rank	Rank Order
Identifying relevant information	5.41	2
Identifying sources of information	3.98	6
Retrieving relevant information	4.76	5
Archiving relevant information	2.37	8
Interpretation of contracts and justifying claims	4.83	4
Response to architect/engineer's request for information	3.75	7
Quantifying claims	5.22	3
Prepare claims documents for presentation	5.68	1
W	Significance	
0.22	0.00	

Further analysis of the contractors' responses revealed that more than two-thirds of them rated the time involved in the five highest ranked aspects of claims preparation between 6 and 10 on a 0 - 10 scale. The statistically significant level of agreement (W= 0.23) therefore implies that all aspects of the claims management process are essentially time consuming.

Three main reasons can explain the clear indication that preparing claims takes a lot of time. Firstly, the construction industry is notorious for not documenting procedures and transactions. Kangari [28], attributes this failing to a tendency to regard information management as a non-value-added component of the construction process. The interviews and case studies (Chapter Seven) suggests that most of the information recorded is of a cost accounting nature. The problem with this type of records is that, they do not contain information relating directly to resource usage on scheduled project activities but only indicate apparent fluctuations in the cost of the project. The second is that information on project activities are not readily accessible to individuals assigned these roles. Lastly, in an environment where most project information is transferred using the paper medium, the identification and subsequent retrieval of relevant information will be time consuming. Whichever situation applies, there is clear need for systematic documentation of project activities.

The problem of documentation can be tackled in two complementary ways. The first strategy will be to put in place a matrix of documents designed to record specific information with an appropriate electronic document management system (EDMS) for each project. The main aim would be to record information capable of supporting claims preparation instead of relying on cost accounting records.

However, in order to implement these remedial measures effectively considerable retraining complemented with appropriate change in management strategies will be required (Chapter Twelve). This can be linked to corporate total quality management systems providing assurance that the document management system is being operated satisfactorily.

6.4.3 Cost involved in preparing claims

The Contractors were also asked to indicate which aspects of the claims preparation process entailed most cost. The aim, as in the case of time involved in claims preparation, was to identify the reasons for the lack of enthusiasm by contractors to prepare fully documented claims soon after the occurrence of relevant events. Their response (Table 6.6) suggests that preparing the claim documents, quantifying the claim, retrieving information and identifying claims relevant information, in that order, are the most expensive.

Table 6.6 : Cost involved in aspects of claims preparation

Aspect of claim preparation	Mean Rank	Rank Order
Identifying relevant information	5.08	3
Identifying sources of information	4.17	5
Retrieving relevant information	5.75	2
Archiving relevant information	2.50	6
Interpretation of contracts and justifying claims	4.75	4
Response to architect/engineers request for information	4.75	4
Quantifying claims	5.75	2
Preparing claims documents for presentation	7.00	1
W	Significance	
0.497	0.165	

Follow-up interviews suggested not only a lack of skill to prepare the claim, but also that the cost of gathering relevant information for quantification is high. Many interviewees suggested that, in order to avoid the additional cost of retrieving claims relevant information, contractors use general formulae, or the so called "global claim". This approach has been castigated repeatedly by the UK courts, notably in *J. Crosby & Sons v. Portland Urban District Council* [138] and *London Borough of Merton v.*

Stanley Hugh Leach [124]. Presenting detailed information is therefore not the initial tactic where some form of settlement can be reached through negotiation. This probably accounts for the equal ranking for "response to architect/engineer's request for information" and "justification and interpretation of events" (Table 6.6).

As such, any system designed to alleviate these problems should enable access to facts by identifying events responsible for cost and time overruns and the parties responsible. In this respect, contractors have to examine what is recorded and put in place clear and simple methods for recording time and resource usage on specific project activities.

In order to develop a viable system, it will be necessary for contractors to examine the potential cost savings of implementing electronic document management systems as opposed to pure paper-based document management. These systems are examined in Chapter Ten of the thesis.

6.4.4 Heads of claims likely to be disputed

The most common cost headings of construction claims are (§§3.4.0): on-site overheads, head office overheads, loss of profit, inflation of costs, interest and finance charges, cost of disruption and preparing claims. A lot of attention has been devoted to ways of quantifying them and their justification in law. The literature suggests that each item of cost presents its own special difficulties (Chapter Three). However, differences of opinion exist as to reasons for these difficulties. To gain an indication of which aspect of the quantification of these costs require special effort or attention, the contractors were asked to rate the extent to which recovery of each element is disputed in practice (on a scale of 0 = not likely to 10 = most likely). The aim of this question was to determine the most problem-prone head of claim for detailed investigation for necessary improvements.

The results of the analysis, shown in Table 6.7, indicate that the cost of preparing claims, loss of profit and disruption cost are most likely to be disputed in practice. The high and significant value of concordance (*W*= 0.61) suggests that the order of ranks is a true reflection of the experience of most contractors. These are assesed in turn.

Table 6.7: Heads of claims likely to be disputed

Head of claim	Mean Rank	Rank Order
On-site overheads	1.60	8
Head-office overheads	4.60	4
Loss of profit	6.20	2
Inflation of costs	2.50	7
Interest and finance charges	4.30	5
Cost of disruption	5.90	3
Cost of preparing claims	6.80	1
Others	4.10	6
W	Significance	
0.6143	0.00	

Of particular significance is the high ranking of the cost of preparing claims. The review of literature, confirmed in interviews, with consultants (§§6.5.3.2), indicate that this head of claim is disputed in principle. The argument against acceptance is that, because most construction contract terms expressly anticipate the submission of claims, the contractor should make provision for this cost in pricing tenders. However, it was suggested by Powell-Smith and Sims [2] that where the nature of the claim entails more input into preparation than can be reasonably anticipated then the contractor must establish a special cause for recovery. The acceptance of this head of claim however depends on the terms of the particular contract.

Further analysis showed that each head of claim listed in the questionnaire was rated between 5-10 by more than 50% of the respondents. This indicates that, although the rankings suggest, for example, that on-site overheads were least likely to disputed, its quantification maybe a frequent source of dispute. To establish the reasons for disputes over quantification of each head of claim, the respondents were also asked to indicate, on a similar scale, aspects of the quantification of each head of claim which are likely to be sources of disputes. The contractors' responses to this question are presented and discussed below as follows.

6.4.4.1 On-site overheads

On-site overheads relate to the direct costs incurred on site by the contractor. These include preliminaries, site supervision, plant, labour and material costs (Chapter Three). In order to establish reasons why this head of claim might be disputed in practice, the respondents were asked to indicate on 0 - 10 scale (0 = not likely to be disputed to 10 = most likely to be disputed) the likelihood of a particular item being disputed. Their responses (Table 6.8) suggest that the availability of the contractors' build-up of preliminaries, plant and supervision costs, in that order, are most likely to the subject of dispute.

Table 6.8: Contractors' Ranking of Aspects of On-site Overheads Quantification

Aspect of quantification	Mean Rank	Rank Order
Unit cost of plant	3.83	2
Unit cost of materials	2.22	5
Cost of supervisory and management staff	3.33	3
Unit cost of labour	3.22	4
Availability of contractors' build-up of preliminaries	3.94	1
Others	2.10	6

W	Significance
0.2011	0.071

In this instance, although the value of concordance (W = 0.21) is not statistically significant. The order of ranks however indicates that, from the contractors' view in quantifying on-site overheads it may be necessary to make available the build-up of preliminaries. Also attention has to be paid to rates quoted for plant use on site. The indication here is that, whilst it might be acceptable for contractors to quote a percentage of the cost of works as preliminaries in tendering, using the same approach in quantifying claims often leads to disputes. For those contractors intent on a quick settlement, it may well be necessary to make a full disclosure of their build-up of preliminaries (subject to confidentiality). It may also be beneficial for employers to consider making the submission of contractors build-up of preliminaries a condition for accepting tenders.

6.4.4.2 Head-office overheads

There has been a long standing debate over the best method for quantifying head office overheads (§§3.6.2). Despite this uncertainty, it is common practice for claimants to use formulae to estimate this element of a claim. The *Hudson's* and *Emden's* formulae are used in the United Kingdom while the equivalent *Eichleay* formula is used in the United States [2]. The respondents were asked to indicate the likelihood of a number of aspects or methods of quantifying head office overheads resulting in disputes. The aim was to give some indication of best practice for quantifying this item of costs in the light of the on-going debate.

The aspects and methods of quantification considered were: claimed percentage for general head office overheads, inadequate records of head office involvement, recoverability in principle, use of *Hudson's* and *Emden's* formula and use of general formulae. The result is shown in Table 6.9. The order ranks suggest that, the use of general formulae or applying a percentage to direct costs as general head office overheads was most likely to lead to dispute.

Table 6.9: Contractors' Ranking Of Aspects of Head Office Overheads Quantification

Aspect of quantification	Mean Rank	Rank Order
Using percentage of general office overheads	5.50	2
Inadequate records of direct head office involvement	3.25	4
Recoverability in principle	2.50	5
Use of Hudson's formula	4.75	3
Use of Emden's formula	4.75	3
Use of general formulae	6.00	1
Others	1.25	6
W	Significance	
0.73	0.19	

The lack of statistical significance in this instance is understandable given the arguments over the acceptability of formulae. The view had been advanced following the Canadian case of *Ellis-Don Ltd v. Parking Authority of Toronto* [96] and the subsequent English court decisions in *Whitall Builders Co. Ltd v. Chester-le-Street District Council* [137] and *Finnegan Ltd v. Sheffield City Council* [97] that the *Hudson* formula had been given judicial approval. However, the decision in *Tate & Lyle Food and Distribution Ltd. v. Greater London Council* [84] appeared to suggest that the burden of proof to which a contractor can be subjected was not diminished by using such formulae (Chapter Three). To complicate matters, some commentators interpreted the *Ellis-Don* and *Finnegan* cases as a judicial endorsement of the *Emden's* but not the *Hudson's* formula [142]. Even though the recent articles by Kirsh [99] and Humphrey [137], sought to clarify this confusion, the responses suggest that the debate is not yet over. It does however appear that alternatives to this approach, possibly the use of audited cost records as discussed in Chapter Three (§§**3.8.0**), may be required to stem disputes related to the quantum of head office overheads, particularly in circumstances where the assumptions underlying the use of the formulae do not apply.

6.4.4.3 Loss of Profit

One of the most debated heads of claim are those for loss of profit. In law this item can be claimed as part of loss and expense [138]. The questionnaire required the respondents to rank lack of evidence of alternative profit making opportunity and profitability on current project as causes of disputes. The analysis suggests that loss of profit claims by contractors are more likely to be disputed on the basis of lack of proof of alternative profit making opportunity rather than lack of evidence of profitability on the current project (Table 6.10).

Table 6.10: aspects of loss of profit claims

Aspect of loss of profit	Mean Rank	Rank Order
Lack of evidence of alternative profit making	3.28	1
Lack of evidence of profitability on current project	.2.13	2
Others	1.50	3
W	Significance	
0.4643	0.1561	

This suggests an acceptance of the principle that a claimant must offer evidence of alternative profit making opportunity as stated in the landmark case of *Peak Construction v. Mckinney Foundation Ltd.*, [100]. The contractor, it seems, must be capable of showing profitability elsewhere for the claim to be accepted. However, the lack of significance of concordance suggests this might not always be the determining factor. Contractors may therefore have to consider accompanying claims documentation with the audited accounts and bid invitations to demonstrate their capacity to earn the profits stated in the claim.

6.4.4.4 Inflation of Cost

Respondents were asked to consider two main issues relating to the quantification of inflation of costs: lack of evidence of extra costs beyond fluctuation allowance and recoverability in principle. The analysis of their response suggests that evidence of additional costs was more important as a reason for this head of claim being disputed. This implies that, providing evidence of cost escalation using contemporary records is required. The lack of statistical significance does not however confirm this ranking (Table 6.11).

Table 6.11: Aspects of inflation of cost claims

Aspect of inflation of cost	Mean Rank	Rank Order
Evidence of extra cost	2.75	1
Recoverability in principle	2.00	2
Others	1.25	3
W	Significance	
0.75	0.2231	

6.4.4.5 Loss of productivity or disruption

A recent case study of 24 construction projects reported by Semple *et al* [19] found that 50% of the value of claims were for loss of productivity or disruption. According to the authors this resulted from a combination of reasons including acceleration which presents significant problems in assigning responsibility for costs [150]. The general approach in the quantification of this head of claim is to extract the labour and plant content of the work affected assuming no disturbance, determining the actual costs of these elements and to take the difference as the amount reimbursable. However, allowance has to be made for extra costs which are incurred because of the contractor's own default. Within this general approach, the following specific methods are commonly used:

- evaluation of plant and labour records,
- review of labour/plant activity,
- analysis of extensions of time,
- application of a general productivity formula.

Most of these methods assume that the contractor has maintained adequate records of performance on the disrupted activities not only during the period of the disruption but also in normal times. Most UK standard forms contain provisions which empower the contract administrator to require the contractor to keep records pertaining to situations likely to give rise to this head of claims. However, most of them are silent on the type and detail of programming required, the detail, format and general quality of records, and sanctions against failure to comply (Chapter Four). The difficulty in the UK stems mainly from the fact that the requirements for such programmes are not enforceable contractually. The consequence in the case of programmes of work is that it is not possible to use them as benchmarks for assessing actual performance without controversy. As a result a valuable tool for settling disputes is lost [114] and consequently, the recourse to the global claims approach to which most consultants object. This was aptly illustrated by the arguments put forward in the case of *Alfred MacAlpine Humberoak v. McDermott International Inc.* [151].

To give some indication of what would constitutes good practice in costing this item, the respondents were asked to indicate the likelihood of the following issues relating to its quantification leading to disputes. These are: (i) the lack of plant and labour records; (ii) inappropriate allocation of responsibility for disruption; (iii) application of general formulae and (iv) general percentages. The order of ranks (Table 6.12) suggests clearly that applying general percentages or using general formulae are generally unacceptable as methods for evaluating this item. Establishing this head of claim using contemporary records of site activity is much more acceptable than the formulae approach. The absence of statistical significance of the concordance (*W* of 0.21) could in fact mean that lack of records, allocation of responsibility and use of formulae and percentages are each potential sources of dispute as far as the evaluation of disruption claims are concerned.

Table 6.12: Aspects of disruption and loss of productivity quantification

Aspect of disruption	Mean Rank	Rank Order
Lack of plant and labour records	2.60	3
Allocation of responsibility for disruption	2.50	4
Use of general formulae	3.70	2
Use of general percentages	3.80	1
Others	2.40	5
W	Significance	
0.21	0.38	

To remove this potential source of dispute Wallace [76], for example, suggests that it would be good practice to analyse closely any contract programme required to be supplied by the contractor. This can be done by correlating the resource information in the programme to the contractor's recorded labour and plant output on site. By comparing the deployment of resources documented in contemporary records to available publications of plant and labour usage rates of better known construction processes, it may be possible evaluate disruption and loss productivity. The difficulty in the UK is that, the preparation of resource loaded programme of works is not a requirement of most standard construction contracts (Chapter Four).

The case studies (Chapter Seven) suggests that this situation is made worse by the fact that where this was done, the programme did not represent the actual sequence of works, was never updated and was in the form of a bar chart . The result is that many contractors are unaware of critical path analysis techniques as tools for demonstrating cause and effect both for disruption and delay claims.

To enable programmes to be used to assist in evaluating the extent of disruption (and delays for that matter) not only should the preparation and maintenance of resource loaded programme be standard practice, the relevant contractual terms have to make it a requirement to prepare and maintain network schedules using critical path methods. In the absence of a mandatory resource loaded programme it only stands to reason that disputes over the quantum of disruption will continue (Chapter Twelve).

6.4.5 Extent of use of project documentation

A lot has been made of the need to keep adequate records to substantiate claims [140, 141]. What actually happens in practice, according some observers, is the exact opposite. In order to substantiate these assertions contractors were asked to indicate, from their experience, the documents likely to be used in their claim submissions. Their response (Table 6.13) derived from a 0 - 10 scale (0 = never used to 10 = always used) indicates that correspondence, conditions of contract and schedules are the most intensely used while site activity records such as day works records, time sheets, revised drawings, records of delay and disturbance and analysis of tender are least likely to be used.

Table 6.13: Likely use of certain documents in claim presentation

Document	Mean Rank	Rank Order
Bills of quantity	5.67	13
Claim documentation	11.00	4
Minutes of site meetings	8.58	9
Schedules	11.67	3
Photographs	8.92	7
Site diaries	8.83	5
Level records	4.08	15
Conditions of contract	11.83	2
Correspondence	13.50	1
Timesheets	9.58	6
Dayworks records	6.92	11
Records of delay and disturbance	8.25	10
Specifications	8.67	8
Analysis of tender	4.50	14
Revised drawings	6.58	12

W	Significance
0.39	0.002

This response is important because, contractors have indicated that information retrieval and identification of claim relevant information for claims preparation are the most costly and time consuming aspects of claims preparation (§§6.4.3 and §§6.4.4). The absence of site records in claim documentation, as their response suggests, can be attributed to one of two possible reasons. First, the retrieval of information from paper-based records after project completion is expensive. Contractors would rather not attempt to use them if a reasonable settlement can be achieved without them. Secondly, the relevant site records might not be accessible because no systematic method of site documentation exists. In both instances the experience of most consultants interviewed was that such detailed records are necessary to establish the facts as to what actually happened and to resolve differences of opinion (§§6.5.4). Without the benefit of access to documentary evidence of additional resource deployment, the cost history of the project is left to the imagination of the parties in dispute [109]. It will therefore be in the interest of contractors to endeavour to make the necessary resources available to document adequately scheduled project activities. Furthermore, without taking this essential step a definite advantage is lost in any subsequent formal proceedings [28].

The low ranking of bills of quantities and analysis of tender was contrary to the expectation. Clarification was therefore sought during interviews. The contractors' justification was that, as their claims were usually for actual "loss" and/or "expense" arising from defaults of the owner, the rates in the bills of quantities and analysis of tender (being historical) were not an appropriate basis of pricing.

6.4.6 Use of External Consultants

Consultants specialising in claims management are now common place. However, the reasons for the growth of this speciality is a matter of opinion. In this regard the respondents were asked to indicate the circumstances under which they would use external claims consultants. Of the respondents, 24.5% indicates that, they would use external consultants at arbitration hearings, 10% when the work load was high, 26.5 at arbitration hearings when the value of claim is high, and 10% at arbitration when their work load was high. It can be implied that, the arbitration process has become so formalised, as suggested by recent articles on dispute resolution [1], that it requires as much preparation as actual litigation (Table 6.14).

Table 6.14: Use of external consultants

Circumstance	% of respondents
For all claims	2
When the value of claim is high	10.2
At arbitration hearings	24.5
At arbitration hearing when claim value is high	26.5
High work load	10.2
At arbitration hearing when work load is high	10.2
Engage solicitors	2
Other reasons	14.3

This means that not only will additional management resources be expended internally by the contractor in preparing and negotiating claims but if he fails there is the additional cost of consultants to consider in formal proceedings.

6.4.7 Orientation to Claims

When asked to indicate their orientation to claims i.e. whether they pursue claims with all effort or avoid making them altogether, the analysis by turnover suggests that the medium to large contractors (turnover greater than £10 million) were more likely to pursue claims with all effort. The general response however, indicates an ambivalent attitude. A mean orientation of 5.51 on a 0 - 10 scale (where 0 = never submit claims and 10 = pursue claims with all effort) indicates that perhaps, most contractors do not like to be seen as claims-conscious, contrary to the view held by many owners and consultants. Further analysis (Table 6.15) revealed that civil engineering contractors were more likely to pursue claims compared with building or building and civil engineering contractors.

Table 6.15: Orientation to claims

Category of Contractor	Mean Orientation
Building contractor	4.5
Civil engineering contractor	8.8
Building and civil engineering contractor	5.5
Others	7.8

This probably means that the use of re-measurement contracts for civil engineering works which provide some latitude to reassess rates and quantities gives civil contractors more scope to negotiate claims.

6.4.8 General comments

The respondents were asked to make general comments on the reasons or factors that delay preparation and settlement of claims. The categorisation of the comments is shown in Table 6.16.

Table 6.16: Reasons for delay in claims preparation

Reason for delay in preparing claims	% of respondents
Lack of resources	25
Experience no delays	2.1
Showing cause and effect	14.6
Lack of contemporary records	20.8
Poor records	10.4
Identifying and retrieving information	14.6
Awaiting response form Architect/engineer	2.1
Poor records and lack of agreement on events	2.1
Time limitations	2.1
Agreeing to events	4.2
Others	7.8

The analysis indicates that lack of resources is mentioned by 25%, lack of records by a fifth, identification and retrieval of information by almost 15%. The overall message is that, there is a need to reconsider seriously documentation protocols and resourcing of claims management.

6.5.0 DISCUSSION OF CONSULTANTS SURVEY

6.5.1 Responsibility for evaluating claims

Some questionnaires were returned uncompleted from architects. Their stated explanation was that, as they normally pass claims onto Project Quantity Surveyor (PQS) for evaluation, they could not contribute meaningfully to the research. There is something to be said for such delegation because the PQS has no conflict of interest when assessing the impact of any contributory defaults of the Architect. However, there is a need for concern for two reasons. Firstly, it is doubtful whether the standard forms of contracts concerned allow for that degree of delegation. Secondly, if the reason is lack of relevant expertise, as it appeared from the comments, one wonders whether such deficiency might not manifest itself as avoidable grounds for claims and lack of vigilance at crucial times on matters most likely to be exploited subsequently by the contractor.

The expertise, skills and workload of the person responsible for evaluating a claim submitted by a contractor must be a major contributory factor in it's satisfactory negotiation and settlement. Any meaningful review of the claim management process must therefore include a critical examination of the performance of this function. To this end the consultants were asked to score the usual involvement of the various members of a project team.

Analysis of their responses, summarised in Table 6.17, suggests that the PQS has a greater degree of involvement in the evaluation of claims than the owner's Architect/Engineer (A/E).

Table 6.17: Level of involvement of project team members in claims evaluation

Project Team Member	Mean Rank	Rank Order
Project. Architect/Engineer	3.60	2
Project Quantity Surveyor	3.68	1
Project Manager	2.97	3
Client	1.95	5
Others involved	2.81	4
W	Significance	
0.22	0.00	

Most UK standard forms of contract allocate this responsibility to the A/E. The implication of this finding is that actual performance of the function is delegated to Quantity Surveyors. Some standard forms, especially those designed for building contracts, expressly authorise some delegation. However, the Institution of Civil Engineers' Conditions of Contract [144] are silent on delegation in this area of contract administration. The interviews indicated that many civil engineering firms either sub-contract this function to independent quantity surveying firms with experience of civil engineering work or have in their employment personnel with expertise in civil engineering quantity surveying.

The low score for owners was not unexpected. The general understanding is that, in performing the claims evaluation function, the A/E acts as an independent expert holding the balance evenly between the contractor and the owner. However, according to a number of interviewees, this tradition is being departed from in two types of situations.

Some Consultants said they treat claims on public projects with special caution. This is because owners, such as the Department of Transport and the Ministry of Defence, insist that claims are submitted and evaluated to the letter of the contract. Such organisations demand a full audit of claims before authorising payment. The effect of this type of attitude is often longer delays of final accounts than experienced in private sector projects. Apparently, some very well organised contractors are aware of this difference and will usually have in place more methodical claims management procedures on public projects.

Some Contractors interviewed in the parallel survey said that their overwhelming experience has been that very early access by the contractor to a person with authority to settle claims in the owners' organisation, especially private sector owners, will often reduce considerably any controversy surrounding troublesome claims. Indeed, a recent report of the European Construction Institute [148] recommends earlier and greater owner involvement in claims management. A possible rationalisation of this departure from tradition is that, in some cases, the owner's A/E, who may have been the cause of the events giving rise to the claim, would require detachment on a superhuman scale to be impartial.

With claims allowed by the A/E, the traditional attitude of owners has been to take it all on the chin with recriminations sometimes of an unhealthy "claims attitude" on the part of contractors. The contribution of the consultants was rarely ever questioned. However, this attitude is changing. Recent cases brought before English courts should send a chill down many an A/E's spine. In *Wessex Regional Health Authority v. A.R.C. Building Ltd. and Another*([145] Architects were found liable to the owner for claims won by a Contractor. In *Mid-Glamorgan County Council v. Devonald Williams and*

Partners [146] the owner brought proceedings against its architects alleging failure to supply information on time, among other complaints. In *Wharf Properties Ltd. v. Eric Cumine Associates,* [149] a Hong Kong case which was appealed to the Privy Council (the highest appeal court for British colonies that have retained its jurisdiction) in the UK, the owner reached a compromise on claims with contractors and then sought to recover his liability from the architects on grounds of their having issued unnecessary and excessive variations. The suit was struck off but only on ground of failure to provide sufficient particulars on the quantum of damages sought.

This liability is in the face of provisions in most standard forms which empowers the A/E to award time extensions and loss and/or expense claims to contractors for their own default. Clause 26.2 of the JCT80 for example includes events such as the late issue of instructions, drawings and other design information, postponement of works and instructions. Faced with this situation it imperative that the employer plays a greater role in making of such vital decisions otherwise claims that can be settled speedily will end up in court [153].

6.5.2 Reasons for rejecting contractor's claims

The point has already been made that a lot of effort has been directed at redrafting contracts and to improve of parties' ability to interpret terms of contract (§§**1.3.0**). Whether this emphasis has had any impact in the attempts to improve contractual relations has not been established. In this respect, consultants were asked to indicate the main grounds on which they reject part or all of contractors claims. In all cases, the respondents were asked to indicate using a 0 - 10 scale (where 0 = not frequent to 10 = most frequent) the frequency of citing a particular reason as grounds for rejecting all or part of contractors claims.

The ranking of their response in Table 6.18 suggests that, the reasons most commonly cited are non-entitlement in principle, inadequate information or quantification of claim in that order. The ranking was statistically significant with concordance (*W*) of 0.38. The respondents ranked lack of breakdown of claims by causes above non-compliance with contractual procedures.

Table 6.18: Reasons for rejection of part or all of contractors claims

Reason	Mean Rank	Rank Order
Non-entitlement in principle	6.20	1
Non-compliance with contractual procedures	4.20	5
Inadequate information	6.00	2
Breakdown of claim by causes	4.57	4
Inadequate effort at mitigation	3.93	6
Validity of Architect/Engineer's instructions	2.43	7
Quantification of claim	5.50	3
Other grounds	3.17	8
W	Significance	
0.38	0.001	

6.5.2.1 Non-entitlement in principle

The fact that non-entitlement in principle is the most common ground for rejection of claims is contrary to expectation. Many expert commentators, e.g., Powell-Smith and Sims [2], write that justification of a claim in principle was hardly ever a problem. There are two possible explanations for this unexpected finding. Firstly, the understanding of the terms of the standard forms is still inadequate in spite of the large volume of information dedicated to interpreting them (§§1.3.0). Secondly, there is high incidence of contractors submitting unmeritorious claims on the off chance that a satisfactory outcome may just turn up. In the words of Zack [13], some contractors may be of the conviction that "*if I throw enough chaff into the air, money is bound to fall out*". This attitude may have been encouraged by a history of success with *ex gratia* claims (claims the owner accepts out of kindness rather than a contractual obligation) (Chapter Three).

6.5.2.2 Inadequate Information

Although the quality of contractor's information has generally been impugned by many writers, it was hoped that the larger contractors would have reduced the scale of this problem as a spin-off of computerisation. However, the case studies (see Chapter Seven) and interviews indicated that, with the exception of a few exemplars, the problem has hardly been affected by size and computerisation. It was a common comment among consultants that what little information is submitted to support claims are usually captured by systems designed to produce internal accounting information which has, at best, only the most tenuous connection with claims. Investigation of the underlying causes of this problem identified: (i) a culture of bias against paperwork on the part of site operatives; (ii) poor design of recording systems; (iii) the paper-based nature of most of the relevant information; (iv) poor resourcing of the claims management role in contracting organisations.

It would appear that owners, by accepting some poorly substantiated claims, have failed to provide contractors with a real incentive to improve the quality of their information systems. As some contractors openly admitted that, even where the information is available, it is usually very expensive to retrieve and organise in the format required to support claims for various reasons (§§6.4.0): (i) the information is paper-based; (ii) it is scattered over many different functional roles; (iii) claims tend to be submitted after completion by which time the parties with the requisite understanding of the information might moved on. To avoid this expense, contractors adopt a strategy of submitting claims, in the first instance, with minimum supporting information in the hope of getting away with it through their negotiation or "*claimsmanship*" skills. Many consultants commented that it was common for information that had not been forthcoming from contractors to surface during subsequent litigation or arbitration proceedings.

6.5.2.3 Lack of breakdown by causes

A common anecdote at construction law seminars is that many a contractor waits until completion, determines the actual cost of carrying the works and then submits a claim representing the excess of this figure over the tender allowance for costs. It is further claimed that, usually, no attempt is made to particularise the amount claimed by causal events. In the UK this approach to quantification has been dubbed the "*global claim*" or "*rolled-up claim*" (Chapter Three). In the US they are referred to as "*total cost claims*" [13, 131]

The courts have repeatedly commented on the global claims approach. *J. Crosby & Sons v. Portland District Council* [139] was referred to the court from an arbitration concerning claims for variations and suspension of the works. The arbitrator found that, out of a total delay of 46 weeks, 31 weeks had been caused by matters for which the owner was responsible. A lump sum award was made against the owner for this element of the delay. One of the points of law referred to the court was whether the arbitrator should have provided a breakdown of the sum awarded by the various causative events for which the owner was responsible. The arbitrator justified his award as follows:

> *"The result, in terms of delay and disorganisation, of each of the matters referred to above was a continuing one. As each matter*

occurred its consequences were added to the cumulative consequences of the matters which had preceded it. The delay and disorganisation which ultimately resulted was cumulative and attributable to the combined effect of all these matters. It is therefore impracticable, if not impossible, to assess the additional expense caused by delay and disorganisation due to any of these matters in isolation from the other matters"

The judge rejected the argument that the arbitrator should have provided such a breakdown in the following terms:

"since the extent of the extra cost incurred depends upon an extremely complex interaction between the consequences of the various denials, suspensions and variations, it may be difficult or even impossible to make an accurate apportionment of the total extra between the several causative events...I can see no reason why he should not recognise the realities of the situation and make individual awards in respect of those parts of the individual items of the claim which can be dealt with in isolation and a supplementary award in respect of the remainder of these claims as a composite."

A brief analysis of the decision was presented in chapter Five (§§ **5.4.2**) but, the common interpretation has been that it is justification of the global claim approach. From the gloss put on the judgement in subsequent cases [145, 155], the current position on the global claim approach may be summarised as follows:

1. If the terms of the particular contract contains preconditions regarding what must done in respect of specific events relied upon as giving rise to the claim, then those preconditions must be complied with.

2. A proper nexus should be established between each event relied upon and the amount claimed.

3. Where the events give rise to so complex and interacting consequences that establishing this nexus for individual events is impossible or impracticable, it is permissible to maintain a composite claim. The burden of proof of impossibility or impracticability of particularisation is on the contractor.

The global claim problem is inherently more difficult for contractors to overcome than the other grounds upon which claims are rejected [131]. However, in terms of frequency in practice, it has been ranked only fourth and with a score below 5. This suggests that, the extent of the problem may have been exaggerated by the high profile nature of the relevant court cases. Consultants interviewed indicated that, where reasonable efforts at particularisation are made, which have due regard to the realities of complexities of cause and effect on construction projects, an award can be made. However, every interviewee said they had come across the worst examples of the global claim approach, particularly in connection with costs of disruption.

6.5.3 Heads of Claims Likely To Be Disputed

The research suggests that many claims are rejected by owners' contract administrator either wholly or in part. This is unsatisfactory on two grounds. The abortive costs of preparing and assembling the relevant information, preparing and submitting claims are likely to be passed on to future owners, and ultimately to the wider society. Secondly, rejections often results in disputes which are then resolved at great expense. There is therefore the need not only to avoid unmeritorious claims but also to ensure that valid claims are submitted in a manner calculated for acceptance with minimum fuss.

With this need in mind, one of the objectives of the research questionnaire was to determine the heads of claim often in dispute (as considered by Contractor in §§6.4.4). Knowledge of such heads and the grounds upon which they are rejected would be the ideal bases for improving the preparation, documentation and evaluation of claims. The responses of the consultants (shown on Table 6.19) indicated that the heads most commonly in dispute are: (i) cost of disruption, (ii) head office overheads, (iii) cost of preparing the claim. Although not in the same order, the Contractors' similarly ranked these in the top three (§§6.4.4). The reasons for rejection are discussed in turn for each head.

Table 6.19: Heads of claims likely to be disputed

Head of claim	Mean Rank	Rank Order
On-site overheads	3.66	7
Head-office overheads	4.84	2
Loss of profit	4.11	5
Inflation of costs	3.76	6
Interest and finance charges	4.82	3
Cost of disruption	6.61	1
Cost of preparing claims	4.26	4
Others	3.95	8
W	Significance	
0.1988	0.000	

6.5.3.1 Cost of disruption

To gain a measure of what consultants expect from contractors in quantifying this head of claim they were asked to rate the following: lack of plant and labour records, inappropriate allocation of responsibility for disruption and the use of general formulae for quantification as likely reasons for the quantum of disruption being disputed. Their response (Table 6.20) which is statistically significant suggests that, lack of plant and labour records, followed by inappropriate allocation of responsibility for disruption are the most important reasons for disputes over the quantification of disruption.

Table 6.20: Aspects of cost of disruption quantification

Aspect of disruption claims	Mean Rank	Rank Order
Lack of plant and labour records	3.76	1
Allocation of responsibility	3.53	2
Use of general formulae	2.58	4
Use of general percentages	2.84	3
Others	2.21	5
W	Significance	
0.2410	0.001	

All the Consultants interviewed lamented frequent lack of records and general poor quality of what was available, particularly contractors' programmes. Most were only in the form of Gantt charts and were hardly ever a true reflection of the actual sequence of construction on site.

Interviewees also complained that in the absence of adequate records, contractors resort to claiming percentages of total labour estimates or actual labour costs of disrupted operations as the reimbursable element for disruption. The main drawback of this approach is that there was usually no objective justification for the percentage used.

Interviewees nevertheless understood that, even with the best records, this head of claim is very difficult to estimate with any degree of precision. It should therefore not be surprising that it was scored significantly higher than other heads. From the case studies and interviews desirable remedial strategies include: (i) procurement systems that give the contractor a real incentive to improve his management information systems; (ii) greater use of the contract administrators' powers to demand that certain information on disruptions be supplied; (iii) contractual provisions that require the contractor to supply time-impact analysis; (iv) systematic and productivity studies to arrive at acceptable productivity formulae.

6.5.3.2 Cost of Preparing the Claim

Many claims take up a lot of managerial time to research and compile. Indeed, there is a growing industry in specialised claims consultancy available to contractors and sub-contractors where claims are particularly onerous on directly employed staff. Whether the cost of preparing of claim, either in in-house or through independent claims consultants, is reimbursable has been a matter of considerable controversy. According to one school of thought, where the terms of a contract expressly provide for the submission of claims, then the contractor would be deemed to have priced for the cost of preparing the claims and should therefore not be entitled to recover this head. Most of the consultants interviewed subscribed to this view and invariably disallow this head.

A contrasting view is that where the contractor has to carry out special research in order to quantify the claim and the scope of such research could not reasonably have been foreseen at the time of tendering, then the cost of preparing the claim ought to be allowed. It was a common view of contractors that in the current state of the construction industry, the amount of effort would satisfy this condition in most cases. On one of the projects studied, it took the contractor's quantity surveyor and site manager and an external claims consultants 12 working weeks to assemble an approximately £300,000 claim. The fees payable to the consultants alone were a staggering £60,000 (Chapter Seven). Consultants, whilst expressing the view that they were bound to comply with the principle of non-recoverability, nevertheless recognised that in the current climate of competition in construction, making allowances for costs of this scale in a tender would almost certainly result in loss of the bid.

Many contractors continue to claim this head of cost even though they are aware of the argument against recoverability. Analysis of the law suggests that they have chances of winning if they persist with the claim. The reason is that if the claim ends up in litigation and the contractor chooses to formulate the claim as damages for breach of contract and not damages under the terms of the contract, the costs would be allowed under the principles governing the recovery of damages of breach of contract [106]. An express exclusion of such costs may not even bite because of legislation against unfair terms in contracts.

It would therefore appear that there is no completely satisfactory way of avoiding this type of dispute purely by contractual provisions. The fact that some contractors persist with this head of claim suggests that owners and contractors compromise and agree some recovery. Contractors can minimise this costs by: (i) site management practices and integrated management information systems that allow transparent access to all claims-relevant information; and (ii) contract management personnel with appropriate expertise in claims. However, the current culture of keeping information up parties' sleeves works against the desired transparency. A way around the problem is for owners and the advisers to put by far greater emphasis on bidders' site management practices and information systems than has been the norm. It may be that this approach will result in the acceptance of higher tenders. If the benefit is less disputes during contract execution it may be a price worth paying.

6.5.3.3 On-site overheads

Consultants were also asked to indicate the likelihood of a number of aspects of on-site overheads causing disputes in practice. The analysis of consultants responses indicates that, the non-availability of contractor's build-ups of unit prices, unit cost of labour and plant are the most likely reason for on-site costs being disputed (Table 6.21). The statistically significant level of concordance (*W* of 0.23) suggest that disagreements over the quantification of this head of claim are most likely to be over the contractor preliminaries, labour or site management costs.

Table 6.21: Aspects of on-site costs

Aspect of on-site overheads	Mean Rank	Rank Order
Unit cost of plant	3.02	4
Unit cost of materials	2.87	5
Costs of supervisory and management staff	3.52	3
Unit cost of labour	4.57	1
Availability of contractors' build up of preliminaries	4.15	2
Others	2.87	5
W		Significance
0.2335		0.000

This is significant because, it is common practice according to consultants for contractors to quote rates for labour and plant which are very different from those in the Bills of Quantities or Schedule of Rates. This approach to claim calculation ignores the principle of valuation of additional expenditure set out in most standard forms of contract. The Contractors argue that such rates were justified because the actions of the owner or agents as the case may be often change the whole economics of many project activities (**§§6.4.4.1**). It was therefore, a travesty of justice for owners to expect them to use rates comparable to those in the original bids.

The issue of the availability the contractors build-up of preliminaries is quite revealing. In practice contractor often quote a percentage of the contract price to cover preliminary costs. In claims situations however, clients and contract administrators appear to demand to see their build-ups in justifying them instead of a percentage of the value of the claim. Consequently, for those contractors interested in speedy settlement, providing the details of extended preliminaries backed up by the necessary records is the only way to avoid disputes.

6.5.3.4 Head Office Overheads and profit

To gauge the degree of controversy surrounding these heads, the consultants were asked to indicate the frequency of rejection on specific grounds. Tables 6.22 and 6.23 summarise their responses. It would appear that consultants, by and large, accept the use of the formulae and that the extensive literature on the subject is beginning to achieve the desired effect.

Table 6.22: Aspects of head office overheads

Aspects of head office overheads	Mean Rank	Rank Order
Applying a % for general head office overheads	5.50	1
Inadequate record of direct head office	4.79	2
Recoverability in principle	4.29	3
Use of Hudson's formula	3.17	5
Use of Emden's formula	3.17	5
Use of general formulae	4.08	4
Others	3.00	6
W		Significance
0.27		0.003

Table 6.23: Aspects of loss of profit claims

Head of claim	Mean Rank	Rank Order
Lack of evidence of alternative profit making	2.36	1
Lack of evidence of profitability on current project	2.26	2
Others	1.47	3
W	Significance	
0.35	0.001	

It was concluded from the case studies and interviews that these heads of claim are challenged mostly on grounds of lack of the proof of the underlying assumptions. Owners wishing to eliminate this problem altogether may consider agreeing the percentages as terms of their contracts.

This implies that the use of general formulae especially without substantive records of direct head office involvement is not good practice. The contractors who succeed in claiming this item of cost would usually have to provide consultants with information on the trading accounts to justify their claim. This practice is encouraged by Kirsh [99], Powell-Smith and Sims [2], Sims [143, 151] and Sykes [152] who explained that although the use of formulae such as *Hudson*, *Emden* or *Eichleay* have not been given express judicial approval, instead their use within specific criteria may be acceptable.

6.5.3.5 Inflation of cost

The analysis of consultants response indicates that, the principle is not a very important issue (Table 6.24) compared to contractors' ability to present evidence of additional costs beyond that allowed in the contract. Cost records, according to consultants, should be available for an informed ascertainment to be made to avoid disputes.

Table 6.24: Aspects of inflation cost claims

Aspect of inflation cost	Mean Rank	Rank Order
Evidence of extra cost	2.50	1
Recoverability in principle	2.21	2
Others	1.29	3
W	Significance	
0.48	0.001	

6.5.4 Supporting Documents

Consultants were asked to indicate on a 0-10 scale their perceptions of the frequency with which contractors fail to submit specific documents required for the evaluation of claims. Their responses (summarised in Table 10) indicate that the documents most lacking are photographs, timesheets, and site diaries.

Table 6.25: Document lacking in claims presented by contractors

Document	Mean Rank	Rank Order
Revised drawings	10.95	4
Levels records	6.30	14
Site diaries	11.20	3
Photographs	13.50	1
Schedules	7.55	12
Minutes of site meetings	6.55	13
Analysis of tender	9.10	5
Specifications	5.25	16
Records of delay and disturbance	8.65	7
Time sheets	11.35	2
Correspondence	8.75	6
Conditions of contract	8.05	8
Bills of Quantity	8.00	9
Day works records	7.85	10
Claim documentation	7.65	11
Other documents	5.30	15
W	Significance	
0.27	0.000	

As these are the most basic of site records, this finding is a sad reflection on the quality of site management. From interviews with contractors, even where these records have been kept, access to the specific records required to support a particular claim is so expensive that it is not attempted unless arbitration on litigation is contemplated. Interviews with contractors showed that poor rèsourcing of the claims management function in most cases does not permit maintenance of the records of the requisite quality. It would appear that there is a general tendency to ignore claims until after completion, by which time human resource can be freed from other functions to investigate the claim.

The technology required to reduce the expense of access is now well established. Electronic document management systems are now routinely used by insurers and banks. They allow information stored in different forms to be linked and accessed flexibly by subject matter with minimal transaction costs. It is a matter of some regret that few contractors are even beginning to appreciate the values of these systems (Chapter Three).

6.6.0 Summary

The survey of contractors and consultants revealed many practical problems that hinder effective claims management.The main findings of this investigation so far are as follows:

1. ONE OF THE MAIN REASONS FOR THE REJECTION OF ALL OR PART OF CONTRACTORS' CLAIMS BY CONSULTANTS IS THE PROVISION OF INADEQUATE INFORMATION AND LACK OF JUSTIFICATION OF THEIR CLAIMS.

2. OF ALL THE ASPECTS OF CLAIMS PREPARATION, THE IDENTIFICATION OF CLAIMS RELEVANT INFORMATION, THEIR RETRIEVAL AND CLAIMS DOCUMENT PREPARATION INVOLVE MOST TIME AND COST TO THE CONTRACTOR.

3. THE INABILITY OF CONTRACTOR TO PRESENT CLAIMS WITHIN REASONABLE TIME IS A CONSEQUENCE OF A LACK OF RESOURCES.

4. MOST CONTRACTORS ARE INCLINED TO USE THEIR OWN STAFF TO PREPARE CLAIMS RATHER THAN USE EXTERNAL CONSULTANTS.

5. THE USE OF FORMULAE TO QUANTIFY CLAIMS IS A MAJOR REASON FOR DISAGREEMENTS OVER QUANTUM

6. THE QUANTUM OF ON-SITE OVERHEADS IS LIKELY TO BE DISPUTED BECAUSE OF THE NON-AVAILABILITY OF CONTRACTOR'S BUILD-UP OF PRELIMINARIES AND LACK OF PLANT AND LABOUR RECORDS.

7.A GREAT OF RELIANCE IS PLACED ON THE COST REPORTS FROM THE ACCOUNTS DEPARTMENT DESIGNED FOR BUDGETARY CONTROL TO DETERMINE RESOURCE ALLOCATION.

CHAPTER SEVEN

CASE STUDIES OF CLAIMS

7.1.0 Introduction

The research has so far established that, the submission of claims is a common feature of construction contracts. The review of the literature (Chapter Three), the evaluation of the contractual framework (Chapter Four) and the subsequent interviews with both contractors and consultants after the postal survey (Chapter Six) indicated that even with the best efforts some claims are unavoidable. There is therefore the need to develop a system for dealing with such claims speedily.

From the contractor's perspective, the preparation and evaluation of claims raises not only important but costly management issues regarding the identification of relevant information, retrieving such information, the quantification of the claim and assembling the claim document (§§6.4.0). The analysis of the process as it is undertaken will lead to the adoption of solutions that can considerably speed up the process and reduce the cost it currently involves.

This chapter reports the main findings of case studies of claims situations carried out with the permission of a major UK contractor rated among the top ten. For legal and confidential reasons the real names of the projects and sites as well as the contractor name cannot be disclosed.

7.2.0 Objectives of the case studies

The broad aim of this stage of the research is the optimisation of the claims management process through the application of Information Technology (IT) and improved management procedures. The achievement of this aim entailed the attainment of three objectives (§§**2.8.0**):

1. to determine the aspects of claims preparation and evaluation responsible for unacceptable disputes, delay and costs;

2. to establish the pattern of flow of claims-relevant information among project participants;

3. to determine the adequacy of the main sources of information for quantifying items of cost often included in claims;

The first objective was met partly by questionnaire survey (§§**6.3.0**) and observation of real claim situations. The Case study report here are appropriate for the second and third objectives

7.2.1 Number of Projects

Claim documentation on three current and recently completed projects were studied along with associated project records. The projects consisted of two civil engineering projects and three building projects with contract sums between £2,000,000 and £20,000,000.

7.2.2. Format of Claim

All the claim documents studied had the following sections:

- Project Outline;
- Statement of Claim;
- Claim Narrative;
- Quantification;
- Appendices.

This is the format recommended by the most popular textbooks.

7.2.2.1 Project Outline

The project outline gave a brief description of the project. This include information such as the location of site, duration, contract sum and conditions of contract used.

7.2.2.2 Statement of claim

The section was a summary of the total claim for payment being made. It was simply a summation of individual claims.

7.2.2.3 Claim Narrative

This section of the claim documentation consisted of a list of events or actions for claims for which reimbursement was being made. The event is narrated, citing correspondence and the terms of contract upon which the claim was based.

7.2.2.4 Quantification

This section contain the detailed calculation of each event listed in the claim narrative. The items of cost were as identified in (§§3.4.2.). Namely cost of delays and disruption, on-site overheads, interest and finance charges, inflation of costs and cost of claim preparation

7.2.2.5 Appendices

The appendices to all documentation studied included a schedule of letters exchanged on the subject matter, an as-built and as-planned schedule which is referenced in the narrative and quantification sections.

7.3.0 Documents Used In Claims Preparation

The contractor has five main functional departments that generate information required by the QS in the preparation and evaluation of claims. These sources were additional to site reports the QS receives during the course of each project from the Site Agent. The relevant information sources can be classified into four main categories:

- site reports;
- in-house cost reports;
- communication with clients agent;
- general project documents.

7.3.1 Site reports

The Site Agents, as part of project monitoring, are required to fill out several report sheets and forms designed to record information on labour, plant and material allocation, certain events, sub-contractor's work activities and any instructions issues by the Project Consultant. The examination of these forms, in terms of scope, suggested that, they covered essentially almost all the possible information the QS might require. These provide the QS with a record of events on site and the nature of the resources employed on specific activities which are then transferred into relevant files after practical completion.

From the review of these records it appeared that at first glance that if properly completed they provide an invaluable source of data on the effect of events for which contractor may be entitled to claim additional expense under contract. Copies of these were available to the QSs in the form of manual, hand-written documents completed as the contract progresses. The relevant documents are listed in Table 7.1.

Table 7.1: Categories of Site Reports

Report Sheet	Information Content	Staff Responsible
Foreman's or Ganger's Daily Return	1. Lists categories of trades employed 2. Hours spent and 3. Activities undertaken by gang members	Foreman/Ganger
Site Daily Return	1. Work done(direct works) with brief details including location, and difficulties encountered. 2. Work done by sub-contractors 3. Instructions or Variations received 4. Reasons for any delay and disruption of works 5. Lists numbers and names of labour employed on site 6. Plant type used and total hours.	Site Agent
Daily Record	1. Description of work done, materials used and their quantities 2. Labour/Trades employed and for how long 3. Plant used and the period of use	Site Agent
Operatives Time Sheets	Period and time worked by operatives	Site Agent
Labour and Plant Allocation Sheets	1. Description of work done 2. Number and names of operatives 3. Plant used	Site Agent

7.3.2 In-house reports

The in-house reports come in the form of weekly or monthly summary of labour, plant and material cost on each project assigned to an in-house construction trades and activity coding system. These reports, generated by the Accounts department, were based on reconciled invoices of plant and material received from the site agents and suppliers. The reports contain cumulative costs which are available to the QS on a monthly or weekly basis in the form of print out or from workstations (Appendix 5). Closer examination showed that these reports are essentially designed for cost accounting purposes and were therefore, of value only, in terms of giving an indication of increased costs of plant, labour and material beyond the original tender projections. The observation of the process of generating these reports also revealed that, the labour costs were calculated from two main sources: Labour Hire Agencies and recorded timesheets. The cost of site management was calculated and transmitted to the regional office from the head office in the form staff allocation sheets. These contain information on the salary, travel cost of all project management staff.

7.3.3 Communication with Client's Agents

Correspondence between the area office and consultants were in the form of letters which touched on various aspects of each project. These were filed manually by specific project issues. For example, the correspondence on variations or request for information are kept under separate file headings under each project. On the projects examined these run in hundreds of sheets of paper.

7.3.4 General Project Documents

These refer to documents generated from the initial bidding to the award of contract handed over to the QS at the beginning of the project. These included as on most construction projects the following:

- detailed architectural and structural drawings;
- bills of quantities;
- specifications;

- conditions of contract;
- project plans and schedules;
- method statements.

At functional level the sources of these documents are shown in table 7.2.

Table 7. 2: General Project Documents

Document	Source
Detailed architectural and structural drawings	Consultant
Bills of quantities	Estimating
Specifications	Consultant
Conditions of contract	Consultant
Project plans and schedules	Planning
Method statements	Planning

7.4.0 Extracting information used to evaluate claims

The information sources listed in §§7.3.0 are the main source of data the QSs relied on to evaluate the various items of cost in the claims examined. In line with the research objective to establish the difficulty of claims preparation, the information or data sources were examined to establish the relative ease with which the contents of these reports could be used to relate events on site to costs claimed.

7.4.1 Cost reports

These were relied on heavily by the QS to evaluate all items of cost. However, from the format of the Operational Cost Reports (OCS) (Appendix 5) it was difficult to link the compensating events often listed in the narrative of claims and their quantification to the contents of these reports. The reason for this difficulty is that firstly, the overall weekly costs did not relate to particular activities on the original scheduled activities which had been delayed or disrupted. Secondly, in situations of disruptions, the lack of separation of costs to activities meant that, only the increased cost comparison to the budgeted cost is available.

The difficulty this presents to the QSs in attempting to show cause and effect of delay and disruption is discussed in subsequent sections of this chapter (§§ **7.5.0**).

7.4.2 Site reports

The most relevant of these reports are timesheets, plant and labour allocation sheets, operations sheets and site dairies (Table 7.1). These essentially chronicle events on site and provide a microscopic view of project activities, their progress and resources allocated to them. It was apparent that although they were not easy reports to complete. However, if properly completed routinely, they could relieve the QS of the problem of constantly trying to reconstruct events months or years after occurrence from memory or sketchy personal diaries, or as was often the practice from cost reports.

7.4.3 General project documents

The sources of these documents are as listed in §§7.3. The documents that bear most on the most claims studied are the planned schedules prepared by the planning department. As benchmarks for determining how the project scope had been affected by events on site, they are very important but for the fact that, in the opinion of the QSs they very often deficient in the following respects:

- they did not represent the logic and dependencies between various site activities;
- they were not updated once the project commenced and ;
- they were often in the form of simplistic bar charts.

The consequence, according to the QSs is that in almost every case they had to reconstruct the sequence of activities and logic from scratch. This was done very often from memory to generate an as-built sequence to demonstrate delay and disruption. Further interviews with senior managers on this issue revealed that although they realised the importance of maintaining detailed schedule of works it was not the practice on every project because in most of the standard forms this is not a requirement.

7.5.0 Items of cost and information sources

In line with the objective of this case study to establish the claims management information flow and the adequacy of these sources a proforma shown in appendix 7-B-Proforma was designed. The meaning of the terms used in the proforma are as listed in the glossary.

Each claim document was analysed event by event. This analyses were essential for the design of effective and efficient information sharing interfaces between functional areas and/or applications necessary for outlining the proposed computer-based solution. The items of cost claimed were reviewed, their source and nature established. In addition, for each claim the documentation referred to in substantiating the costs were noted.

7.5.1 Determining information flow

Claims documentation on three projects were studied. The first, the construction of a new district hospital in South East England involved substantial demolition and interfacing of crucial activities such as the relocation of plant generator which should remain on-line. Severe delay and disruption was experienced due to inaccurate information on the location of important mains ducts.

The second, a pure civil engineering work involved the reclamation of an old mine. Here, the substance of the claim related to the relocation of utilities, discovery of old bombs which resulted in winter working,

The third, a building project was an extension to an existing structure and the construction of a new structure. The new structure involved the erection of long span steel frames for a sports hall. Disruption and delays were experienced as a result of alleged defective design, fabrication problems of the superstructure and foundations.

Each claim was related to an element of claim and subsequently to a data item while source and divisional ownership of source document was established through interviews with QSs. The generic system, if any used to process each data item were established by interviewing staff and observing instances of such processing. Samples of each report from which data items retrieved were obtained. Appendix 5 provides such a list and some sample copies.

7.5.1.1 On-site overheads

This was a common head of claim in all twenty individual claims examined. The main functional/information sources the QSs use to evaluate this cost item are tabulated below.

Table 7.3: Cost items and their sources of data

Cost item	Document(s)	Divisional ownership(information source)
Plant cost	1. PCR 2. WHTR 3. RLA	Accounts/Site Office
Materials cost	OTMR	Accounts
Management and supervision	1. SAS 2. ABS	HQ(Accounts)/Planning/ QS
Labour costs	WSLR	Accounts

In order to quantify the elements of this head of claim, the QS had to study the hard copy of the daily or weekly cost reports on plant, labour and material costs. Also available to the QSs were the daily site reports referred to in section 7 (§§7.3.0). Analysing these manual records to identify these items took them considerable time and effort. The site reports in particular, were not usually used because of their sheer volume. In one instance where an external consultant was used, it took the QS, his Site Agent and the consultant approximately three working months to simply extract these costs items from the site reports.

The QSs cite this practical difficulty as the main reason they do not as a rule present claims with all the relevant records. This confirmed the finding of the postal survey that retrieval and identification of claims relevant information were time consuming and costly (§§ 6.4.0).

7.5.1.2 Head office overheads and profit

In the documents studied, the establishment of this cost was based on information sent to the QS from Head-office via the accounts department. This was usually in the form of a paper copy of facsimile message transmitted to the QS on request. The breakdown of the calculation which is not shown in the quantification section of the claims document itself is based the on area, region and national trading figures. A sample calculation for one of the projects studied is shown in Appendix 6.

7.5.1.3 Inflation of costs

This item was not a feature of any of the claims studied. This is probably because the project duration in question were less than three years.

7.5.1.4. Cost of disruption and delay

The costing of this item of claim was not in any instance clear. In quantifying this item references were made to correspondence and to the series of events that allegedly indicate the likely cause of inefficient working or delay. With respect to disruption, a percentage was often applied to planned labour and plant cost from the bills of quantity to arrive at a figure. The research found that none of site reports (§§ 7.4.0) likely to point to activities affected and the actual resources allocated, used in estimating the disruption or included in the claims document. In one instance a NEDO publication [157], referring to percentages that can be assigned to certain kinds of disruption was used for quantification.

The difficulty for the QSs here lies in their inability to access planned resource outlay from, for example, the planning department and actual outlay on site activities to determine the change in actual output. Unable to evaluate the disruption based on project records, the global technique was used in all cases.

The delay quantification was in every case on the basis that if an activity was discontinued for a specific period then the overall project had been delayed for the same. No attempt is made is show that the activity was critical.

This demonstrates that the difficulty encountered in ordinary project management as pointed out by Ndekugri and McCaffer [158]. Poor communication between functional departments therefore hinder effective project management and in fact makes claims management difficult.

7.5.1.5 Cost of preparing claims

Where external consultants were not used, this was based on an estimate of time staff spent on claims preparation. The payroll information provided by head-office on staff involved formed the basis of estimating this cost.

7.5.1.6 Finance and interest charges

The estimation of this head of claim was based on bank records of the area office obtained from the accounts department. Apart from one instance the detailed calculation of these charges on weekly basis was provided with the claims document.

7.5.2 Supporting documentation

For all the claims documents studied, the only supporting evidence for each claim came in the form of planned and as-built schedule to demonstrate delay and/or disruption. Significantly, the as-built schedules had to be re-constructed retrospectively based on the QSs recollection of events and information that they could gather from site reports. In this respect, the QSs were unanimous that with a regularly updated detailed schedule of works the effort required to demonstrate the time and cost impact of site events will be less daunting. They agreed that this task can be assisted considerably by using appropriate scheduling software (§§8.2.3).

Reference is also made to correspondence dealing with the alleged event in the form of schedules of letters, showing dates received, date sent and the subject matter. However, copies of such correspondence are not provided as part of the claims document.

Significantly, copies of site reports that might provide the Engineer/Architect with a picture of the nature of resource allocation, such as the relevant timesheets and plant and labour allocation sheets were not included in the claim documentation. Interviews with the various QSs revealed that such detailed information is provided only where the Engineer/Architect disputes their evaluation and/or requests further details. This practice was cited by consultants as a reason for rejecting parts of claims and more importantly the perception that the claim was fraudulent (§§6.5.0).

Furthermore, the QSs also believed that their main problem in this respect is one of retrieving relevant information from paper sources. They felt that if it were possible for them access most of the information electronically and be able to view them in their original form then a major problem with the claims preparation process would have been removed. Resolving the problem of access from these sources was necessary to reduce the time and cost of the claims evaluation and preparation process thereby encouraging the site reports for claims quantification. The solution for this access problem both at the data and document level (**§§11.4.0**) which is possible using most of the standard electronic document management systems on the market (**§10.0**).

7.5.3 Nature information sources

The documents the QSs had to obtain their information from were all in the form of hard copies although cost reports from the accounts department are available electronically as electronic copies. These run into hundreds of pages of paper. The QS for the purposes of each claim has to go manually through these documents which on one of the claims studied worth about £300,000 required an average of two to three months with the assistance of the site clerk or agent to prepare. They also incurred a consultant's fee of £60,000.00. The impact on contractors ability to prepare claims promptly is obvious (**§§6.5.2**). Most claims are therefore left until after practical completion

7.6.0 The Role of the Quantity Surveyor

The role of the QS in this process is to undertake all stages of the decision making process with little assistance. The documentation, quantification and presentation of the contractors case was their responsibility. By way of logistics the could only rely on their site agents to keep adequate records, and the estimating and valuation departments to aid in quantification. In all the cases examined the QSs were solely responsible for all the activities save word processing.

7.7.0 Summary

The studies of claims preparation and evaluation shows that, the contractor has serious problems with respect to his ability to retrieve and identify relevant information from site reports and within the functional departments.The case study confirms that:

1. the QS is largely responsible for the claims management function;

2. the paper-based nature of the documentation system the claims management function relies on contributes to the poor presentation of claims and the general lack of interest in preparing detailed claims doucments;

3. the practice of using inappropriate project schedulling such as bar charts which were not subsequently maintained limit the contractor's ability to substantiate genuine claims

4. generally, the claims management function is poorly resourced and also not accorded the priority it deserves.

CHAPTER EIGHT

THE ROLE OF INFORMATION TECHNOLOGY IN CONSTRUCTION CLAIMS MANAGEMENT

8.1.0 Introduction

This research amongs others established that improved information management, especially document management was needed to significantly improve claims management. Perhaps one of the principal ways of achieving this goal is to use the Information Technology. Consequently, the research included a review of the IT tools available to determine the aspects of the claims management process they can support.

This chapter presents this review, starting with general application software whilst Chapters Nine and Ten examine expert systems and electronic document management systems repsectively. This review will begin in this chapter with the definition of the main recognised project management functions in construction organisations.

8.2.0 Definition of Project Management Functions

The basic management functions recognised in most construction contracting organisations are:

Planning : The process of choosing the method and sequence of works to be used on project from all the alternatives and sequences possible;

Estimating : The process of collecting and calculating cost data, selecting resources and output rates and combining cost and resource usage to determine the likely cost of works;

Cash flow forecasting : The assessment of the anticipated cost of work in progress at periods or stages for which reimbursement is expected;

Valuation : The process of determining the amount of payment for work done to date;

Control and monitoring: Reconciliation of projected cost of works with actual cost.

Accounting - the process of identifying, measuring, recording and communicating the transactions of the organisation [158].

The analysis of information flow in construction companies (Table 8.1) indicates that, each of these functions depend on information generated by the other.

Table 8.1: Summary of information flow

Generic entity	Source(s)	Users
General Contract Information	Estimating	E/P/CF/V/CC/A
Tender BoQ	External	E/P/V
Specifications	External	E/P/V/CC
Drawings	External	E/P/V/CC
Conditions of Contract	External	E/P/CF/V/CC
Subcontractors' Information	Estimating	E/P/V/CC/A
Suppliers' Information	Estimating	E/P/V/CC/A
Employees' Information	Accounting	E/P

Company Plant Register	Accounting	E/P
Resources Cost Data	Estimating/C. Control	E/P/V/CC/A
labour Output Data	Estimating	E/P/V/CC
Plant Output Data	Estimating	E/P/V/CC
Materials Usage Rates	Estimating	E/P/V/CC
Materials Wastage Factors	Estimating	E/P/V/CC
Unit/Standard Costs	Estimating	E/P/V/CC
Standard Dayworks Schedules	External	E/V
Schedules of Average Rates	External	E/P/V
Management Accounting Information	Accounting	E/V
Past Profit & Loss Accounts	Accounting	E/V
Budget Profit & Loss Accounts	Accounting	E/CF/V
Post-contract Audit	Cost Control	E/P/CF/V/CC
Site Visit Report	Planning	E
Site Investigation Reports	External	E/P/V
Quotations	External	E/P/CF/V/CC/A
Method Statements	Planning	E/V
Pre-tender Programme	Planning	E/CF
Site Organisation	Planning	E/V
Work Breakdown Structure	Planning	E/CC
Project Cashflow Analysis	Cashflow	E/P/V/CC/A
Corporate Cashflow Analysis	Cashflow	E
Market Conditions Data	External	E
Corporate Work-load	Planning	E
Priced BoQ	Estimating	P/V
BoQ Build-ups	Estimating	P/V
BoQ Analysis	Estimating	P/V/CC
Activities Cost Breakdown Data	Estimating/Planning	P/CF/V/CC
Purchase Orders	External	P/V/CC/A
Subcontracts Information	Estimating	P/CF/V/CC/A
Supply Contracts' Information	Estimating	P/CF/V/CC/A
Delivery Notes(plant/materials)	External	P/V/CC/A
Unfixed Materials	Valuations	P/CC
Variation Orders	External	P/CF/V/CC
Valuation of BoQ Items	Valuations	P/CC

Activities	Valuations	P/CC
Instructions from Architect/Engineer	External	P/V/CC
Minutes of Site Meetings	Planning/C. Control	P/V/CC
Master Programme	Planning	CF/V/CC
Schedule of Activities	Estimating/Planning	CF/V/CC
Programme/Progress Schedules	Planning/C. Control	CF/V
Progress Reports	Planning/C. Control	CF/V/A
Invoices (costs)	External	CF/V/CC/A
Invoices(revenue)	Accounts	CF/CC
Ledgers(costs)	Accounting	CF/V/CC
Ledgers(revenue)	Accounting	CF/V/CC
Company's Cost of Borrowing	Accounting	CF
Preliminary Budget	Estimating	V/CC
Short-term Programme	Planning	V/CC
Labour & Plant Timesheets	Cost Control	V/A
Project Dayworks Schedules	Estimating	V
Price Fluctuation Indices	External	V
Payroll	Accounting	V/CC
Resource Reconciliation	Estimating/Planning	V/CC/A
Resource Requirement Schedules	Planning	V/CC
Take-off Data	Estimating	V
Inflation Data	External	V/CC/A
Dayworks Summary Reports	Valuations	CC
Cost Control Standards	Estimating/Planning	CC
Requisitions	Cost Control	CC/A
Claims Information	Valuations	CC
Interim Payment Certificates	Valuations	A
Miscellaneous Payment Receipts	External	A
Final Accounts	Valuation	A

P = Planning, E = Estimating, CF = Cashflow Forecasting, V = Valuations, CC = Cost Control, A = Accounting.

Source: Ndekugri and McCaffer [154], Management of Information flow in construction companies. Journal of Construction Management and Economics, Vol. 6, p 290-291.

The overall performance of the contracting organisation therefore depends on how well these functions communicate from bidding to practical completion. The case studies of claims (Chapter Seven) found that this communication process is paper-based. The consequence is that a lot of data manipulation is carried out with further time consuming contacts for clarification or amplification. In many instances the recipients, the contractors' QS find the information received of such little value that they either re-extract or make-up their own data. The effect of this poor functional communication is the emergence of experts in each functional areas managing islands of information aided by sophisticated software.

However, whilst there are experts within the contracting organisation devoted simply devoted to undertaking planning, estimating, valuation and cost control functions, there are no such recognised or acknowledged experts for claims management (§§ 6.4.1). There are several mutually reinforcing reasons for this. This includes: (i) claims do not arise in every single project; (ii) there is no separate role for managing claims in the way that there are estimators, planners and accountants. The personnel given this role in most cases decided in an ad-hoc manner; (iii) the process of managing claims is relatively ill-structured. Unlike the orderly processes involved in producing an estimate or programme, there no set routines for producing a claim.

The result is that those assigned this important function have to make use of the limited functionality added to software systems intended for other management functions. For example, it is very common in industry to use the Critical Path Analysis software to perform analysis of delays for which owners should be responsible [159, 160, 161]. This situation is compounded by the fact that in the management of claims apart form the need to access internal information sources, information generated from external sources such as design information and site records have to be dealt with as well (Chapter Seven).

This chapter examines the extent to which general application software can be used in the claims management process. The conceptual analysis of the claims management process (§§ 5.3.0) indicated these software can be useful in the claims quantification process. The main focus of this chapter is to review their role in the quantification of claims.

8.3.0 Claims quantification

The main problem with quantification tends to arise in the area of the supporting evidence (§§ 5.2.3). The common practice for contractors faced with the costly task of producing such evidence is to use the global claims approach and formulae which very often results in disputes (§§6.4.0).

The acceptability of formulae for instance has been the subject of controversy for the simple reason the use of these formulae often ignores the evidentiary requirement laid down by the courts (§§3.5.0). In fact, the criticisms levelled against the inherent assumptions of these formulae makes them untenable in legal proceedings where it is possible to more accurately estimate the damage using the relevant records.

The main problems in the quantification of claims are in the areas of (Chapter Six and Seven):

- retrieval of supporting information and ;
- absence of necessary information.

8.3.1 Retrieval of Supporting Information

A large proportion of the documentation containing the necessary information is still paper-based (Chapter Seven). Such sources of information may include (§§5.2.3): analysis of contractor's tender, detailed analysis of preliminaries, programme/progress schedules, correspondence from external organisations, records of site meetings, site diaries, analysis of extensions of time granted, specifications, variation orders, drawings, photographs.

Associated with these paper-based documents is the costly rigmarole of navigating a maze of filing cabinets, desks, drawers, folders sometimes years after completion of the project. The cost of maintaining these paper-based sources are very high (§§ 10.1.0).

In practice individuals charged with this task make use of the limited functions of software systems designed for other recognised functions. These include database systems, spreadsheets and project management software which are the subject of this chapter. These software are reviewed within the context of their capability to assist the claims management process (especially quantification) [160].

8.3.2 Database Systems

The term 'database', as used in this thesis, refers to any organised collection of information, e.g., labour, plant and materials records and other details. In a computer-based database systems, special software, referred to as " database management system" allows the information to be accessed and manipulated in many ways. One could say that, if the database can be seen as electronic library of information, then the database management system is the librarian.

Five kinds of database management systems can be identified [161, 162]: relational database systems, viewdata systems, text retrieval systems, document image processing systems and hypermedia systems. The recent surveys of the use of software applications in the construction industry [163, 164] showed that relational database systems are the most widely used. These are first described followed by a review of the lesser sued database systems.

8.3.2.1 Relational Database Systems

Relational Databases comprise a collection of records, each subdivided into a number of common fields. A typical site record for labour could have the following fields: category of labour, clock number, rate, man-days, total pay and activity reference. Such records can be structured as a series of sequential files with data repeated in different files (or tables) to form logical links which may be supplemented by pointers or index tables. The result is that locating data, therefore, relies on tables/files being related to each through common fields.

For example, plant record with fields of plant type, hours used, activity reference and rate can be linked to labour record via the activity reference (Chapter Twelve). The cost of plant and extended plant used on a delayed activity can be retrieved using the common filed called project activity reference. In addition to these features, some of the more recent relational databases e.g. Foxprow, allow some degree of mathematics, programming and analysis to be performed thereby making it possible to construct powerful repositories of data and permit entry of blocks of text such as abstracts of documents. The electronic "index cards" or records can be searched rapidly and accurately for particular cost data which can be re-organised at will by reference to any field or combination of fields.

The cost of materials, their procurement dates, invoice numbers, labour cost and other cost data which are relevant to the monetary assessment of claims for say, the extra cost resulting from variations to works can stored and retrieved efficiently using these applications. It can be argued that if properly used as part of the contract administration process, the retrieval and location of information related is easily accessible.

However, on account of limitations to text handling capabilities, e.g., text restricted to abstracts, other generic systems are required to compliment information retrieval particularly information in text or graphic format such as hypermedia (§§**8.2.2.4**), text retrieval systems (§§**8.2.2.2**) and document imaging systems (§§**8.2.2.3**).

Uses of Relational Databases

These are used to store information on the work to be done and its related resources such as bills of quantities, activity schedules, resource requirements and availability, unit prices, invoices and cost reports. Experienced contractors would normally make these databases available to other functional software for example planning, estimating and accounting [159, 160]. The individual preparing a claim has to tap into the appropriate database.

In practice accessing relational databases is hampered by two factors. First, the individual must be sufficiently computer-literate to navigate all the systems. However, even with such sufficiency, the databases are islands of information requiring the use of paper copies from which information is re-keyed for claims management purpose (Chapter Seven).

Secondly, the nature of the information available is normally tailored for the need for a particular function (§§**8.1.0**). For example, weekly and monthly cost summaries do not normally indicate when and/or which project activity has been delayed or disrupted (§§ 7.4.1). The activity may also just be part of a cost centre. Furthermore, there is the need to establish the causal link between additional expenditure and disrupting event (§§ 5.2.3). Doing so requires not only the cost reports but a review of more detailed information, such as site diaries, site labour and plant allocation sheets and instructions, which have to be located in a laborious fashion (§§ 7.5.0). All too often the process is a failure and the global claim is submitted. Relational databases by their nature are therefore best suited to support claims quantification.

8.3.2.2 Viewdata Systems

These are two-way interactive systems that allow access to static pages of information held on remote databases [162]. A typical access to a viewdata database is via either a telephone line or dedicated computer communication line although access via radio link is possible. Although these systems can make available large number of pages of information to the user and can be updated frequently and easily, they are limited by the fact that they are only really suitable for storing summaries of documents rather than whole documents [162]

An example of such a system is BLISS which is maintained by J.R. Knowles a leading firm of construction contracts consultants. This particular system enables access to case law summaries, case law reviews, rates and other construction related information.

8.3.2.3 Text Retrieval Systems

These systems have been developed specifically for the handling of whole documents held as electronic files on computers. A user searches the database of documents by issuing Boolean queries, or other syntactic forms, employing keywords and phrases.

The system then returns the titles of documents in which those words or phrases are found [166, 167].

Systems such as DIALOG, have alternative interfaces that, facilitate the search of specific on-line databases. Databases, are chosen by menu selection and once the database is chosen the user is presented with the option for searching fields specific to the database and prompted to enter the appropriate search terms. After the items are retrieved, options for modifying a search include widening them, replacing them, narrowing the subject terms or selecting limits. LEXIS, an on-line system is widely used in the United Kingdom by legal practitioners and academics for retrieval substantive law, offers a similar facility. Its sister system, NEXIS, is used in the United States [168].

Though the precise sequence of operations followed in each of these systems vary, generally the user operates through a terminal, initiating the search after accessing a particular database by entering one or more keywords considered relevant to the search. The system then compares the keywords with the concordance (an alphabetical index of almost all the databases words and their addresses) of full text of that section of the database. The user then has the option, after retrieval of the documents, to modify the search and eventually browse and print out the desired text.

The main drawback of text retrieval systems is that they are not user-friendly. The user has to communicate with the database in Boolean or other special syntax such as SQL [168]. For this reason, human intermediaries in the form of trained technicians are often used with all the disadvantages that this type of arrangement entails. This drawback has received the attention of researchers. Parsaye, Chignell, Khoshafian and Wong [169], Willet [170] and Furnas *et al* [171] point out that, the limitations of the retrieval techniques employed in these systems can be overcome by complementing them with hypertext interfaces (§§8.2.2.4) and expert systems (Chapter Nine).

Prototypes such as those reported by Perrot and Smith [172], Smeaton [173] and Mylonas and Heath [174], interface hypertext environments with existing text retrieval systems, thereby combining the user-friendly nature of hypertext with the powerful tools of the traditional text retrieval techniques.

Uses of Text Retrieval Systems

On the whole, text retrieval systems of the type described were developed for particular classes of users who pay subscription fees and the cost of access by telephone lines. The finding of this research suggests that the cost of these systems they have been restricted to very large organisations. However, a viable area of application is access to standard documents, e.g., standard forms of contract, standard specifications, and construction law cases. Whatever the answer, information available in these systems may be required by an integrated system for claims management.

8.2.2.5 Document Image Processing Systems

Like text retrieval systems, document image processing systems are designed to store and facilitate the handling of large numbers of whole documents. The important difference being that the documents in a text retrieval system are in a processeable form whilst those in document imaging systems are non-processeable electronic copies, usually captured by scanners, of the originals. A processeable document can be searched using text retrieval systems or edited using a word processor in contrast to non-processeable documents. Documents held on microfiche provide a classic paper-based analogy of these systems.

Uses of Document Image Processing System

These systems can serve two main functions in the management of claims on construction projects. The first function is document management in large and complex claims preparation and evaluation for which supporting documentary evidence runs to hundreds of massive paper-based files. Such documents can be scanned into a computer and indexes created for efficient access and retrieval of relevant information. They are used, mostly by large contractors, to archive project documents, e.g., design drawings, correspondence, and diaries of site management, upon project completion.

The advantage of these systems is that, when documents are captured, they are exact copies of the paper-based original not only in appearance but also in content. Also it is much more difficult to tamper with the image of the document. The main disadvantages of these systems are that: (i) the recovery of documents depends entirely upon careful indexing at the time the database is compiled or updated; (ii) as the documents are held as non-processeable images they take up far more computer storage space than their processeable equivalents.

These systems have since been superseded by a new generation of systems referred to as electronic document management systems (EDMS) which incorporate these functions, along with does of the traditional databases. The capability of the latter in the context of improving claims management in general is examined in Chapter Ten.

8.2.2.6 Hypermedia Systems

This section provides a simplified explanation of software tools considered in this research which are part of a family of applications and packages referred to collectively as "hypermedia" systems. The history of the development of these systems are detailed notably by Coklin [175], Nielson [176], Ritchie [177] and Shneiderman and Kearsley [178].

The term "*multi-media*" is used to describe the combination of text, graphic and audio elements of information. The medium is termed "*interactive multi-media*" when the system user can exercise some control over when and what information is viewed. If the design of a multi-media interactive system imposes a structure of links between information elements for navigation and interaction then it becomes "*hypermedia*". When the hypermedia system has a high element of text or symbolic content indexed and linked together to facilitate rapid electronic retrieval of associated information it is referred to as "hypertext" [179, 175, 174]. A key distinction between these applications is that, whilst hypertext applies to text-only applications, hypermedia is used to convey the inclusion of other media.

A typical hypertext system consists of non-sequential text files which are usually sized to fit computer screens and are self-contained. By creating links between related items of information relevant items can be read in any order that reflects the purpose of the user. Figure 8.1 illustrates hypertext systems schematically.

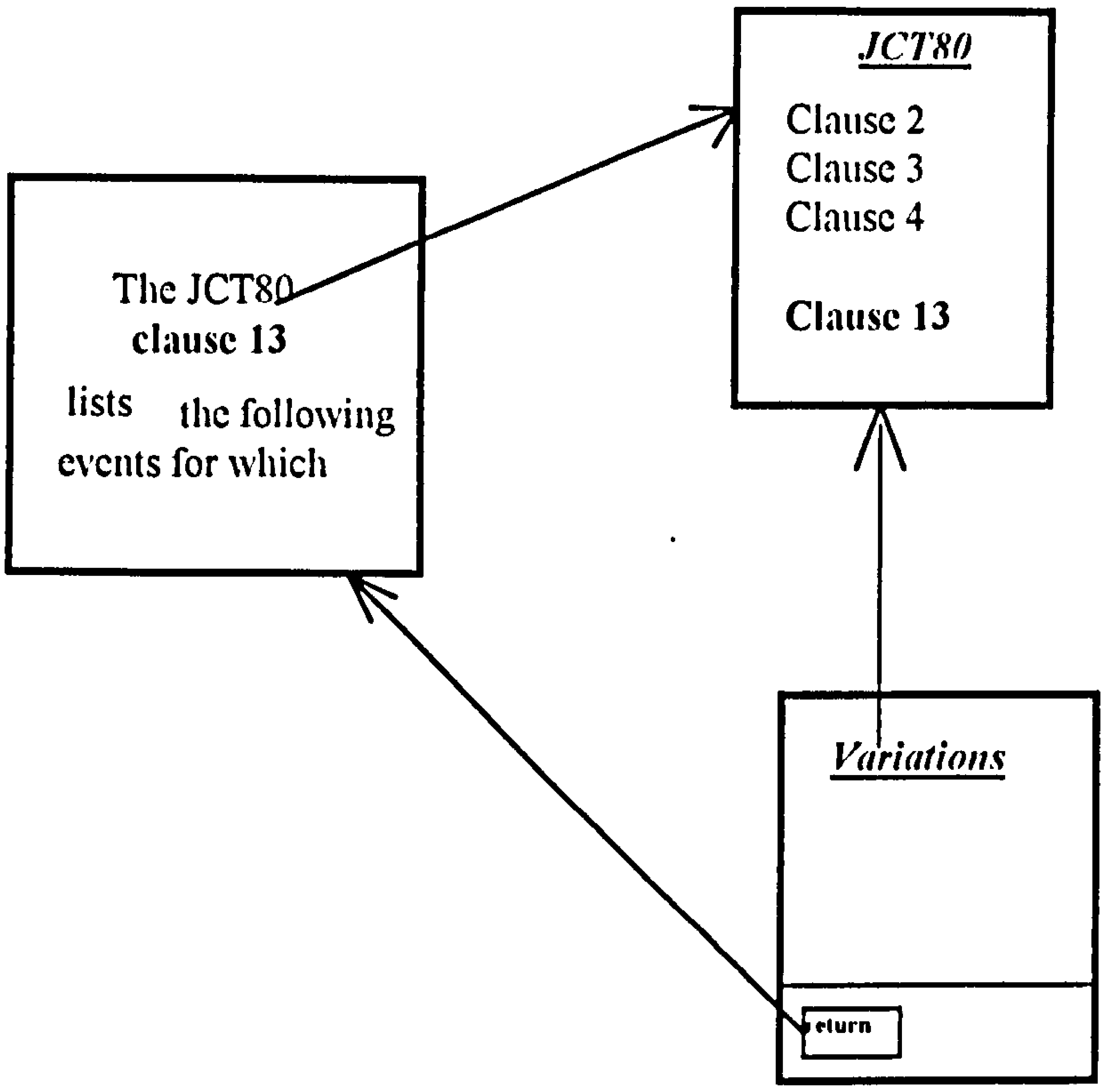


Figure 8.1 : A simple hypertext system

This contrasts with text in conventional text retrieval systems which have to be read from start to finish linearly to discover parts relevant to the needs of the user. These links form a networks of nodes also called "articles", "documents", "files", "cards", "pages", "frames" and "screens", containing information in text, or in the case of hypermedia systems, graphics, video or sound. Many research and commercial packages offering hypertext features have been available since the mid-1980s. Examples include HyperCard (Apple), Notecards (Xerox), KMS (Knowledge Systems Inc.), Guide (OWL International) and Hyperties (Cognetics).

Potential uses of Hypermedia

Shneiderman *et al* [178] identified the required characteristics of domains which are amenable to hypertext application as: (i) where there is a large body of information organised in numerous fragments; (ii) the fragments of this information relate to each other; (iii) access to only small fragments of the information is needed at a time. From the analysis of the decision making process(§§5.2.2), claims management is a prime candidate for hypertext applications especially in the justification process. This conclusion is supported by Foskett [180] and Raymond and Tompa [181] who single out reference books, particularly those of a legal nature, as most suited for hypertext applications. Many construction contract documents, e.g., conditions of contract, specifications, bills of quantities, and method statements are in essence reference information.

The potential of hypertext applications to claims management has already been demonstrated. Williams [182] developed a prototype reference manual to help in the inspection of asphaltic concrete pavements. The information in the application included expert opinion on the subject from the New York State Department of Transportation. A similar system, based on the premise that hypertext can act as an assistant or tutor to help humans perform tasks themselves developed by Bubbers and Christian [183] provides advice on delays under a Canadian standard form of contract. In an integrated system, the hypertext application can provide a user friendly interface for reference information in the justification stage of the claims evaluations process.

8.2.3 Management Application Software (FAS)

The term "functional application software" is used in this thesis to refer to software developed specifically to support management functions in construction, e.g., preparation of bills of quantities, estimating, project planning and control, and plant management, and which are virtually of no use outside construction.

The outputs of these systems are of particular relevance in the quantification and in certain instances justification of claims. For example, the use of CPM software to analyse the effect of delay is now almost routine practice in claims for prolongation has been pointed out in the introduction to this chapter (§§8.1.0). The limitations of these systems, as with the database management systems, is that, while very useful in the mathematical computations and information retrieval necessary to ease the task of demonstrating financial loss to a claimant, it is not possible to demonstrate or evaluate the legal rights and liabilities of parties based solely on their output. The increasing use of these applications is indicated by recent CIOB sponsored surveys [163, 164, 184].

8.2.3.1 Uses of Project Management Software

The common use of these category of software is in the analysis of the effect of delays on the contract completion date. This involves imposing the delaying event and carrying out of a critical analysis to determine the new completion date. By performing a number of "what-if " analysis and storing the results the contractor can prove the effect of a series of delaying events. These applications are also used as forensic tools to construct as-built project schedules to illustrate the impact of event on the original programme [111, 120].

Some of the more sophisticated project management products can be customised to support claims management more directly by:

1. applying the concept of hammock activity. This is a fictional activity the start and finish of which are linked to specific activities. If there is delay its duration is automatically extended. This can be used to monitor the effect of delays on the project preliminaries.

2. information requirements of the contractor can be programmed into the system, the end product being an annotated programme with accompanying schedules

of information requirements. The issue of such a schedule can constitute an application for instructions.

3. some correspondence can be generated upon the happening of defined events.

The limitations of these systems are obvious. The central problem at least where the information is available is one of access across functions to retrieve documents and data. Fortunately, recent developments in the area of electronic document management systems would if adopted enable access. This will relieve substantially the burden of information retrieval (Chapter Ten).

8.2.4 Wordprocessors, Spreadsheets and Computer -Aided Design Systems (CAD)

Word-processing and spreadsheets were some of the earliest software systems to be used to any great extent in construction. In the area of claims management they are used mainly in the preparation of documents and in carrying out analysis requiring large amounts of repetitive computations.

CAD has been, by and large, confined to the design sections of the industry. Even where such systems are used communication of design information to constructors has remained predominantly paper-based. However, with the increasing use of the design and construct procurement method [185] and improvements in facilities for electronic data interchange this may change.

8.2.4.1 Uses Spreadsheets

These are one of the most common IT tools employed in the construction industry. They are useful tool for the number crunching part of the claims preparation.

8.3.0 Limitations of Application Software

Although the utility of these systems are obvious the absence of information limits their use in practice. This is particularly the case with information which establishes a causal link between the amounts claimed and the events giving rise to the claim (Chapter Five). This absence compels contractors to use questionable approaches to the quantification of claims (Chapter Six and Seven). Quite clearly, the utility of any computer system for claims management depends on the relevant information being there. Without proper record keeping all these tools even where fully implemented will be of no value.

8.4.0 Summary

Computers are used in the management of claims. The systems reviewed in this chapter, have been developed for other purposes and therefore, place limitations on the way in which they can support claims management. However, it is notable that although many claims are made in the currency of most projects there are no comprehensive systems designed for claims them. It has been shown in this chapter that these systems are suitable for aspects of the claims management process and can therefore be used in a dedicated system if an adequate level of project activity documentation can be maintained.

CHAPTER NINE

EXPERT SYSTEMS AND CLAIMS MANAGEMENT

9.1.0 Introduction

The claims management process involves jusification of claims in principle (§§5.2.2). This requires understanding of the legal principles and procedures laid down in the standard forms.

The examination of the decision making processes (Chapter Five) and the finding of the survey (Chapter Six) that interpretation of provisions of contract remains a problem suggests that this aspect could be a good domain for a group of IT tools called expert systems implementation. It was therefore one of the aims of the research to investigare this possibility. This chapter reports this investigation first, by giving a brief history of expert systems.

9.2.0 A Brief History of Expert Systems

The concept of the computer being used in the administration and practice of law has been around for decades. Mehl [186] described two types of "law machines" which can enhance legal practice. The documentary machine which can be used to find relevant legal text such as legal precedents which form the basis of judicial decisions and consultation machine capable of drawing on principles of law to give legal advice.

Recent years have seen advances in the use and design of Mehl's documentary machines referred to today as legal text retrieval systems (§§ 8.2.2.2). For these systems, the techniques of storing large volumes of legal text, the design of appropriate user interfaces and the formulation of search strategies are in a large part solved.

However, the insufficiency of text retrieval systems as legal decisions aids has led to research and development of systems not only capable of storage and retrieval of legal information but also able to draw conclusions or give legal advice based on such information. The consultation machines or legal expert systems have such capability [187, 188].

The development of these systems have been made possible by advances in artificial intelligence especially in the area of knowledge acquisition and representation, aided by the emergence of powerful English-like programming languages.

9.3.0 Description of AI Systems

The term "knowledge" used in artificial intelligence (AI) parlance, refers to the information a computer program needs in order to behave or act intelligently. The body of knowledge that forms the basis of the intelligence of the computer, represented in computer format is termed the knowledge base hence the term knowledge-based systems (KBS), intelligent knowledge-based systems (IKBS), knowledge-based expert systems (KBES) or expert systems in AI literature.

In order to act intelligently, the computer has to respond to facts and use rules or other knowledge representation schemes [189] in the knowledge base selectively. The knowledge that guides the choice of responses to facts is termed the inference mechanism or control knowledge. A KBS thus, has a knowledge base and an inference mechanism for selective use of knowledge, which signifies intelligence, and a user interface to interact with the user during run time [190, 191].

The successful development of an expert system in any domain depends on the existence of substantial domain expertise organised for efficient search. The development of a KBS involves [189]:

- acquiring the knowledge by example or any practical means;
- iteratively expanding and refining the knowledge;
- devising efficient knowledge representations and structures;
- effectively using uncertain and inconsistent knowledge.

The design and implementation of expert systems involves three distinguishable processes: (i) knowledge acquisition; (ii) knowledge representation; (iii) knowledge implementation.

9.3.1 Knowledge Acquisition

Knowledge acquisition is the process of transferring domain expertise into implementation formalism. Two basic rules of the thumb can be identified for application to knowledge acquisition for effective problem solving [191]: (i) complex problems are easier to solve if partitioned into nearly decomposable parts, i.e. there should be a strategic division of tasks. Each area of law for example, can be reduced to identifiable concepts; (ii) problems should be analysed completely before solution methods are selected and applied.

Once the knowledge acquisition process is done in a systematic manner then the effort required to represent the knowledge in a suitable format for implementation is reduced.

9.3.2 Knowledge Representation

Three basic methods are adopted to formalise acquired expert knowledge. These are, production rules or rules, semantic networks and frames.

9.3.2.1 Production Rules

Production rules or rules as they are often called are the most common knowledge representation technique [191, 192]. They provide a formal way of representing directives or strategies and are most appropriate where the domain knowledge results from empirical associations accumulated through experience of problem solving. For example most legislative acts can be reduced to **IF-THEN** rules for implementation as exemplified by the system reported by Sergot [193] on the British Nationality Act.

9.3.2.2 Semantic Networks

This term is used to describe knowledge representation methods based on network structure. This representation scheme was originally developed for use as psychological models of human memory but have become one of the standard representational schemes for AI and Expert Systems [191, 194].

A semantic network consists of nodes connected by links called arcs describing the relationship between nodes. Nodes in a semantic net can stand for concepts, objects or events. The arcs are defined in a variety of ways, depending on the nature of the knowledge being represented. The more common of the arcs used for representing hierarchies include **isa** and **has-part** arc. Figure 9.1, shows the structure of a simple semantic net representing the statement "the JCT80 is a type of standard form of contract" and "every standard form of contract is a legal contract".

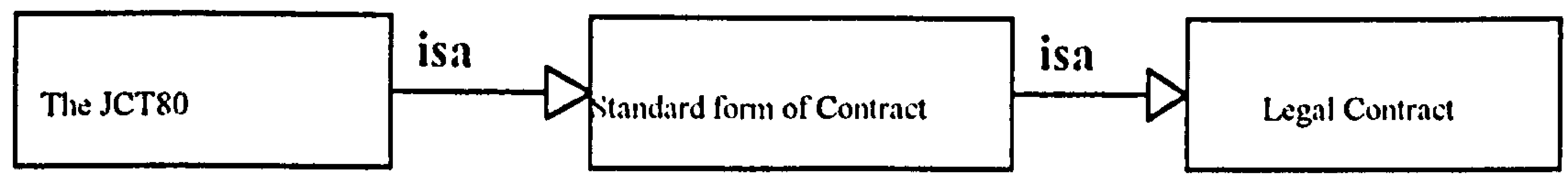


Figure 9.1: A simple semantic net

The **isa**, **has-part** relations and others, makes it possible to establish a property inheritance in the semantic net. The semantic net can be searched using the meaning of the relations in the arcs to establish facts. Semantic nets are therefore useful in representing domains with well established taxonomies to simplify problem solving [191]. Hafner [195] for example, used a semantic net of legal concepts to develop a system to help lawyers retrieve information on court decisions. Based on the same concept, Meldman [196] developed a system to analyse legal cases on intentional torts of battery and assault.

9.3.2.3 Frames

Frames in AI are a special way of representing common concepts and situations. Frames are data structures that present a current stereotyped situation. Frames are organised in much the same way as semantic nets with a network of nodes and relations organised in a hierarchy. The topmost nodes could represent general concepts and the lower nodes specific instances of the concepts. However, the concepts at each node are defined by a collection of attributes (e.g. assault, battery) and the values of those attributes (e.g. bodily harm, incapacitation), where the attributes are called slots. Each slot has procedures attached to it which are executed when the information slot is changed.

Frame-based systems are therefore by their very nature are more suitable for domains about which the form and content of data play an important role in problem solving

[191]. McCarthy [197] used this knowledge representation scheme in the earlier version of the TAXMMAN project.

9.4.0 Implementing Knowledge-based Systems

Four main tools can be identified for the implementation of knowledge-based systems. These are: (i) Programming Languages; (ii) Knowledge Engineering Languages; (iii) System Building Aids; (iv) Support Facilities.

9.4.1 Programming Languages

The programming languages used for expert system applications are generally either problem-oriented languages such as PASCAL and FORTRAN or symbol-manipulation languages such as LISP and PROLOG.

The problem-oriented languages are well suited for classes of problems with features for performing algebraic calculations suited for mathematical as in scientific and statistical problem areas. The symbol-manipulation languages on the other hand, are specifically designed for artificial intelligence applications. Languages like LISP has mechanisms for manipulating symbols in the form of list structures. A list structure being a collection of items enclosed in parentheses, each item a symbol or another list. This kind of language structure has proved to be very useful in representing complex concepts. The main advantage of these languages is the flexibility offered to the systems builder [198].

9.4.2 Knowledge Engineering Languages

These are simply sophisticated environments for expert systems development. They consist of a systems-building language integrated into extensive support facilities (§§ 9.3.4). Knowledge engineering languages or expert system shells as they are often called, were developed by AI researchers specifically for building expert systems and can generally be categorised as skeletal systems or general purpose systems [189].

The skeletal systems are simply expert systems with their domain specific knowledge removed leaving the inference engine and the support facilities. For example, MYCIN a system for diagnosis and treatment of bacterial infection [198] became the skeletal system EMYCIN while PROSPECTOR became KAS [189]. These stripped down expert systems provide a ready made structure and built in facilities that make systems development easier and faster. However, they lack flexibility they can only be applied to a restricted class of problems. This reduces the design options for system developers.

General purpose knowledge engineering languages such as CRYSTAL [199] well known in the UK on the other hand provide some generality in problem areas and types. The majority of expert systems reported in literature use these development environments.

9.4.3 System Building Aids

These are programs designed specifically to help the systems builder in knowledge acquisition and the design of systems. Compared to programming and knowledge engineering languages, very few systems building aids have been fully developed to date. Two categories of these aids exist [200] : design aids e.g. AGE and knowledge acquisition aids e.g. ROGET.

9.4.4 Support Facilities

These are tools for aiding system development. These include debugging aids, knowledge base editors and tools for enhancing the capabilities of the finished system such as built-in input and output (I/O) facilities and automatic explanation generating mechanisms. These facilities normally come as part of knowledge engineering language packages (§§ 9.3.2) designed to work with a particular language. CRYSTAL for example, has a rule tracing facility that displays the system operation by listing all the rules triggered in a consultation and commands executed during test run. This rule listing facility also allows the editing of questions posed during consultation and automatic merging of knowledge bases. Which are useful features for modular systems development.

9.5 0 Implementation Approaches In Law

Legal expert systems are in essence able to store legal knowledge, process such knowledge efficiently in order to make appropriate selections which carry the system towards a defined goal. Which is to provide legal advice.

Researchers in this area face a number of problems. Namely: (i) how best to model the legal decision making process in a manner that allows computerisation; (ii) the best technique for the design and development of knowledge bases in a problem area and; (iii) how to develop suitable mechanisms for searching solutions.

Buchanan and Hendricks [198] while addressing these problems identified four processes used by the lawyer in solving legal problems: (i) the establishment of a goal and a method of measuring progress towards it; (ii) the selection of rules to apply to facts; (iii) the recognition of relevant facts; (iv) the discovery of analogies, by generation of facts or rules.

To model these legal processes two distinct approaches have emerged. The first, is the rule-based approach which uses logical deductions from legal norms and concepts. The second, emphasises the role of analogical reasoning and adopts what is termed, the case-based technique. Lately, neural networks [201] have also emerged as a possible technique for building legal expert systems.

9.5.1 Rule-Based Systems

In these systems the knowledge-base consists of production rules (§§ **9.2.2.1**) deduced case law or statute law statements [202]. The best known of legal expert systems reported in the UK is that of Capper and Susskind [203] on the Latent Damage Act (1986). The system reported by Sergot [193] and recently by Widdison [204] on European Law are typical examples of rule-based systems.

9.5.2 Case-Based Systems

This technique attempts to overcome the over simplification of legal concepts inherent in the rule-based approach. The argument is that even if the law is stated concisely as in statutes, their interpretation depends not on logic deductions used in rule-based (§§ **9.4.1**) but on the case law associated with the legislation.

In a case-based system, the legal concepts that apply to a case are first identified, the case law retrieved by some method and the probable outcome predicted based on them. This models more closely the four processes identified by Buchanan and Hendricks [198] (§§ 9.4.0). One widely cited example of a case-based system, HYPO reported by Rissland and Ashley [205] for instance uses citation vectors to retrieve the "most-on-point-cases" from which the possible outcome of trade secrets law cases can be predicted. Schild [206], Gelbart and Smith [207] and others have used this basic concepts with variations to improve the retrieval of the relevant case law required to predict the likely outcome of a case. Attention has been focused also on developing interfaces to access a larger body of case law.

Conceptually, case-based systems come closest in achieving an ideal model of the legal decision making process for computerisation(§§9.4.0). According to Gelbart and Smith [207] the case-based approach apart from emphasising the importance of analogical reasoning in law, reduces the effort required for knowledge acquisition and representation. This is because the primary heuristics used for pattern matching cases yields a more compact and easy-to-maintain knowledge-base. Despite these advantages, fewer systems are implemented using this approach compared to the rule-based approach.

9.5.3 Neural Networks

A recent addition to the possible ways of developing legal expert systems are neural networks. Neural networks are based on models of the human brain which although known to have a much lower processing speed compared with the modern computer is capable of reasoning with incomplete data using experience and learning. Neural networks seek to model this ability of pattern matching by adopting appropriate programming techniques or changing the architecture of computing systems [208, 209, 210, 211].

This approach involves training a neural network system using existing test cases. During this process the system itself learns to identify generalised patterns from a set of specific examples that it is given. The system can then be used to recognise these patterns in new cases presented to it. In contrast with the methods described earlier a variation of outcomes are possible in a neural network depending on the complexity of concepts that can be incorporated in the network. Carling [212] gives a detailed account of neural networks and compares them with the traditional expert system techniques.

9.5.4 Open texture and Legal Expert Systems

The notion of open texture is often encountered in legal literature. Law and legal concepts are said to exhibit open texture: a legal concept has a definition only for cases that have been come to the courts and been decided. For cases yet to be tested in the courts, the exact definition of legal concepts cannot be determined in advance.

However, where ground breaking cases arise, the courts are guided by precedents which impose an obligations to exercise judicial discretion according certain principles. How legal expert systems can be designed to handle novel cases is a problem which has as yet to be fully addressed in current systems [206]. These limitation aside legal expert systems can still aid legal decision making. Their role in the following section.

9.5.4.1 Role Of Legal Expert Systems

The utility of legal expert systems in the practice of law has been the subject of much debate in the legal community [202]. However, it has become obvious even to its critics that these systems if well designed have at least an educational value. In fact several Law Schools have developed what is widely termed Computer Aided Instruction (CAI) systems [204] to aid the teaching of law. Bainbridge [213] also identified training as a vital area where legal expert systems can be employed.

He argued that where an expert system project is conceived with a clear idea of the intended users, the manner in which the system is intended to help them and the extent of help it is designed to give then it is entirely possible for the system to be fully implemented.

The acceptance of Capper and Susskind's system [203] and GIO's system for motor injury claims evaluation in Australia [214], are classic examples of the advisory role for legal expert systems.

This concept of legal expert systems which stresses the advisory and educational capability according to Bench-Capon [214], removes one of the major obstacles in the practical implementation of these systems i.e. they are intended to augment and not supplant human reasoning. It can deduced that if legal expert systems are seen as a wider exploitation of information technology then their potential role of in legal and quasi-legal capacities such as construction claims management is immense especially where used in conjunction with other systems. The scope for expert systems in claims management is the subject of the rest of this Chapter.

9.6.0 Scope for Expert Systems in Construction Claims Management

The settlement of claims without recourse to costly litigation requires that (§§ 5.3.0) : (i) making claims for reimbursement consistent with the provisions of contract: (i) justifying the claim; and (ii) quantifying such claims in a manner that relates events to costs. The following sections of this Chapter reviews reported legal expert systems with respect to the above listed claims management processes

9.6.1 Claims Justification and Legal Expert Systems

Ensuring that a claim for reimbursement is consistent with express provisions of contract or valid under a general principle of law is the linchpin in evaluating claims (§§5.2.2). Where for example, a contractor suffers or stands to suffer financial loss from the conduct of his employer or others for whom the employer is responsible for in law, the provisions of contract that sanction such entitlement need to be identified.

However, in the absence of express provisions damages could still be recovered for breaches of contract under general law of contract. In fact most standard forms of building and civil engineering contracts preserve such rights.

An important part of this process is to ensure compliance with contractual procedures(§§5.2.1). For example, making application for information or giving notices is a condition precedent to claims for disruption resulting from lack of information. Also, the contractor must provide evidence of compliance. The legal expert systems described next illustrate how expert systems can be applied to the claims justification process.

9.6.1.1 Latent Damage Law Expert System

A foremost example of how the artificial intelligence techniques discussed can be employed in establishing rights and obligation under law where the legal principles are well established is the Latent Damage Law expert system [203].

This system is based on the representation of the Latent Damage Act (1986) which concerns the limitation of actions for damages, i.e. the time beyond which an action becomes statute-barred. Normally, a claim involving damages to property cannot be commenced six years after the occurrence of the damage. Special rules however apply where the damage does not manifest itself for a period of time as is usually the case for defective building foundations. The law dealing with these issues is contained in statutes such as the Limitation Act (1980), together with a rich array of case law.

This system gives advice on whether a breach of duty has occurred and, if so, whether the plaintiff(property owner) is in time to commence action.

Implemented using the CRYSTAL, the knowledge base consists of production rules formalised from the statute-law statements (§§9.4.1). The system during consultation, provides *yes* and *no* prompts to questions, with some textual explanations through a help facility and menu options.

This system essentially demonstrates how complex statutory regulations and law with substantial case law and literature can be reduced into a form that allows the evaluation of rights and obligations in the absence of expert knowledge.

9.6.1.2 Nuisance Advisory System - JURIX

This advisory system is based on a rule guided analysis of nuisance case law [208]. This case-based system addresses the problem of open texture of legal concepts by indexing the knowledge base according to legal concepts. For each concept it is possible to retrieve legal information related to it in the form of relevant precedents, authoritative quotations and argumentation. The system allows consultations to be run several times while changing answers to retrieve additional information.

This system compared to Latent Damage System (§§ **9.5.1.1**) enables the user to try different approaches to a case at hand as well as and hypothetical cases. The information retrieved during consultation then forms the basis of assessing the strength of a case.

9.6.1.3 System for Tax Advice

The system for tax advice, TAXADVISOR [216], a rule-based expert system implemented using EMYCIN assists attorneys with tax and estate planning for clients with large estates. The system collects client data and infers actions the client needs to take to settle there financial profile, including insurance purchases, retirement actions, transfer of wealth and the modification of gift and will provisions. The system uses knowledge about estate planning based on attorneys' experiences and strategies as well as more generally accepted knowledge from literature.

9.6.1.4 Legal Analysis System

The Legal Analysis System reported by Meldman [196] helps lawyers perform legal analysis about intentional torts of assaults and battery. The lawyer presents the system with a set of facts which the system then relates to the relevant legal doctrine. The system then presents the user with its conclusions, including the logic behind them and references to judicial decisions and secondary legal authority to support the conclusion.

The expertise, doctrines and case facts are represented using semantic networks(§§ 9.2.2.2).

9.6.2 Quantifying Claims and Legal Expert Systems

The necessity for showing a causal link between cause and effect has been stressed in the review of case law.

The mathematical techniques for establishing quantum rarely presents any problem apart from large volumes of repetitive calculations involved. These calculations can be performed by general application software such as relational databases and spreadsheets (§§8.2.2).

The main problem tends to arise in the area of the supporting evidence. The following systems illustrate how artificial legal expert systems can be applied to the claims quantification process.

9.6.2.1 System for Asbestos Litigation

Expert systems designed to draw on the experience of experts in establishing the legal validity of a claim and assessing the value of a claim for faster settlement have been reported in literature. One such system, is the System for Asbestos Litigation (SAL) [191].

This rule-based expert system evaluates asbestos claims under Product Liability law in the United States. The system handles one class of diseases, asbestosis, and one class of plaintiffs, insulators. SAL provides estimates of how much money should be paid to plaintiffs in active cases to help promote rapid settlement. The system uses knowledge about damages, defendant liability, plaintiff responsibility and case characteristics such as type of litigants and skill of opposing attorneys. With medical evidence and the law as a basis the system produces money value assessments of the extent of liability. This assessment then forms the basis of the out of court settlements. A similar system for assessing motor injury claims described by Greanleaf [214] is in commercial use in Australia.

9.7.0 Examples of systems designed for claims management

A number of systems have been reported by researchers in construction specifically for claims management. These are briefly described. These are not exhaustive but exemplify the state of the art.

9.7.1 System for resolving contractual disputes

Alshawi and Hope [217] describe an expert system which evaluates the entitlement of a contractor to time extension under the JCT80 extension of time clause (clause 25). The system obtains details such as contract completion date, previous time extensions, site possession afforded the contractor and any notices of delay served by the contractor pursuant to an extension of time required. The information provided is used by the system to evaluate the contractual position with respect to time limits of decisions and the contractual state of the parties at the time of consultation.

As well as advising on the applicability of an extension of time claims, the system encompasses features such as advice on the most appropriate action to be taken by parties in related areas of contract law such as "time at large" situations, liability for liquidated damages, freezing of fluctuations and potential for loss and expense claims.

9.7.2 System for Analysing Changes Claims

SuperChange [218] analyses claims that arise under the changes (variations) clause of the US Federal Acquisition Regulations. The system encodes the legal mechanism under which a US government agency may make unilateral changes to suit their requirements. It evaluates the contractor's ability to obtain suitable compensation or adjustment for the changes for actions of government agency that is considered as changes to the works.

9.7.3 System for Analysing Construction Claims

Reported by Alkass *et al* [218], this system essentially represents a prototype for integrating scheduling functions, with standard applications such as databases and spreadsheets and an expert system to analyse the impact of delays on the contractor progress. The system provides guidance on record keeping and cost estimates preparation needed for presentation of a case.

9.8.0 Weakness of legal expert system for claims management

Given the nature and scale of the problems raised by claims in the survey (Chapter Six) and case studies of claims (Chapter Seven), the expert systems reported in literature based on the information provided suffer from two main drawbacks. First, the techniques employed to represent legal knowledge in these systems do not address the fact that legal concepts often found in construction contract are open textured (§§ 9.4.4). It is not uncommon to come across phrases like "*reasonable time*", "*workman-like manner*", "*regular progress of works*" in provisions of contract. Although some attempt has been made in form of referencing case law from a case database as done by Diekmann and Kim [218] given the level of judgement required it questionable whether the reported systems go far enough to address this issue.

Secondly, the issue of accessing contemporary records of events to establish proof of compliance appears to be beyond the scope of the reported systems but well within the province of document management systems which have emerged in the last five years. This need is necessary as much of the documents are paper-based (Chapter Seven). Researching paper documents is a costly process. As the survey found (§§6.4.0), contractors would not undertake this research unless compelled to do. These weaknesses are probably responsible for the lack of uptake of this technology in the construction industry.

These deficiencies apart interest in their use is not diminished. The use of expert systems in activities such the authoring of contracts to suit each project [220], interpretation of construction contract provisions [221], evaluation of claims [217]; Diekmann and Kim [218] and even their use by all project participants to evaluate the merits of claims during disputes [222] has been proposed. These systems are also seen as vehicles for educating construction professionals on obligations under contractual arrangements common in the industry [223].

To enhance their utility developers have incorporated interfaces to access information processed by other management software such databases, spreadsheets and CPM packages. This trend recognises the influence of such information on rights and obligation under contract. The system reported by Alkass *et al* [219] for example, interfaces a spreadsheet package to analyse delays while Riad *et al* [222] include a package that uses the time impact analysis procedure which involves the use of network-based scheduling tools to identify, quantify and explain the cause of schedule variance.

Despite the obvious advantages of using these systems as these examples illustrate, their implementation is hampered by software and hardware limitations. On going research suggests that as the solutions for these problems are found the introduction of practical systems hinges the level of abstraction these systems must have and their acceptance by the industry as management tools. This will require education and training in order to overcome the industry's reluctance to embrace these tools.

9.8.0 Summary

The taxonomy of expert systems has been described in this chapter. Examples of legal expert systems have been provided to illustrate the potential of expert systems in assisting in the legal evaluation of claims. Systems designed specifically for claims management were also reviewed suggesting that these systems can be applied to claims justification and to some extent quantification. Despite their limitations, they are useful for the training to improve expertise for claims preparation and evaluation.

CHAPTER TEN

ELECTRONIC DOCUMENT MANAGEMENT SOLUTIONS FOR CONSTRUCTION CLAIMS MANAGEMENT

10.1.0 Introduction

In the absence of documentary proof making claims is viewed as an attempt to make more profit on an otherwise marginally profitable project [13]. The conceptual model of the decision making process developed in Chapter Five suggests that the claims management process relies on information from a variety of sources. The case studies of claims preparation (Chapter Seven) revealed that a major hindrance to the contractor's ability to produce well substantiated and properly quantified claims is that, most of sources of claims relevant information are paper-based. This finding supports the results of the survey of contractors (§§6.4.0) which found that in terms of cost and time the most important factor for delays in preparing claims are the identification, retrieval, quantification and assembling of claims documents. To avoid the cost involved in this process contractors to resort to the use of the global claims approach which the review of case law (§§3.5.0) and survey of consultants (§§6.5.0) indicates that this is a major reason for the rejection of contractors claims.

The examination of software applications used or designed to assist claims management (Chapter Eight and Nine) suggests that the utility of these systems are severely limited by their inability to incorporate the wide range of information sources upon which the decision making process in claims management rely. Specifically, accessing and using paper-based information is still predominant in the construction industry.

This chapter examines the possible role Electronic Document Management Systems (EDMS) can play in claims management through the review of literature on the cost of current paper-based systems, EDMS technology, the aspects of the claims management process it can improve and the possible functional role of these systems in an integrated computer-based system. Part of the interpretation of the impact EDMS can make on the claims management is based the author's first hand experience using these software in special workshops and interviews with corporate decision makers in other industries currently applying the technology.

10.2.0 The Cost of Paper-based Document Management

According to Hyland [224] paper-based document management suffer from a number of inefficiencies. These are:

- files are invariably incomplete;
- documents are often duplicated and/or held at multiple storage sites;
- the original paper can only be viewed by one person at a time and tracking of information is laborious;
- retrieval is slow and storage is expensive.

This being the case, one would question the reason why these systems are maintained at all. The answer is simple. Information is extremely valuable and any system is better than no system. Bird [225] examining the problem of document management in the UK construction industry reported that the average white collar worker in the industry handles around 16000 A4 pages of paper a year which includes drawings, letters, memos, minutes of meetings and management reports. Overall, she estimates that the paper mountain created a year amounts to about 16 million pages.

A recent US research also suggests that the average business executive spends approximately one month a year looking for documents [225]. It costs £16,500 to fill a four drawer filing cabinet and another £1,440 to maintain. The research also found that, 3% of documents are mis-filed costing about £80 to retrieve. This research suggests that this adds an additional cost of £2.25 per document filed.

In the construction industry, this management cost is additional to the potential cost of litigation which can result of poor document management [73]. With the current state of the construction industry, the maintenance of these paper-based systems is an unnecessary overhead. A modern document system using the appropriate technology can cater for the wide range information sources required for project management and claims management in particular. The potential for reducing overheads relating to maintaining paper records is now possible through the implementation of Electronic Document Management Systems (EDMS). These generic systems offer the capability to integrate current paper-based documents, microfiche archives, form processing such as for time sheets and a host of other features. This capability afforded by developments in EDMS can ensure that the contractor can access information quickly, efficiently and with the knowledge that every access is complete.

10.3.0 Description of Electronic Document Management Systems

An Electronic Document Management System (EDMS) is a tool for the storage and retrieval of unstructured information. This information can include faxes, word processed documents, spreadsheets, database reports, notes, scanned images and drawings. Although it is possible to consider EDMS from the perspective of the document source, it is more useful to discuss them with reference to three main functional application areas common to these systems:

- Document Image Processing(DIP)
- Full Text Retrieval
- Computer Output to Laser Disk(COLD)

10.3.1 Document Image Processing (DIP)

The modern DIP is in essence the use of computers to store and retrieve images which represents copies of documents. The computer system therefore, replaces the paper filestore (filing cabinet) or micrographic systems(microfilm and microfiche) and in many cases the paper documents can be disposed of completely. Earlier systems based on the same concept were introduced in Chapter Eight (§§ 8.2.2).

The key component of DIP is the input system which includes a scanner together with an associated software. The growing range of scanning systems offer speeds and capabilities to meet all requirements. For example, a small manually fed system is a desk-top device with a throughput capability of around six pages per minute using A4 or smaller paper sizes. Larger devices suitable for A3 to A0 documents are now available. Faster throughput can be achieved with automatic document feeders (ADF) and double sided (duplex) scanning devices which are capable of inputting hundreds of pages per minute.

The scanner is attached to a computer using standard interface. The PC may be stand alone, a dedicated DIP input system (where images are transferred to the user once validated) or part of an overall DIP system where it will be used for input management and retrieval. The scanner is an intelligent device with its own on-board computer which works in conjunction with software in the computer to achieve functionality.

DIP software comprises of two main modules: the image formatting software used to create the computer record including compression routines and the software which determines how the image will be retrieved. Figure 10.1 illustrates the basic operation and components of a simple EDMS for managing claims.

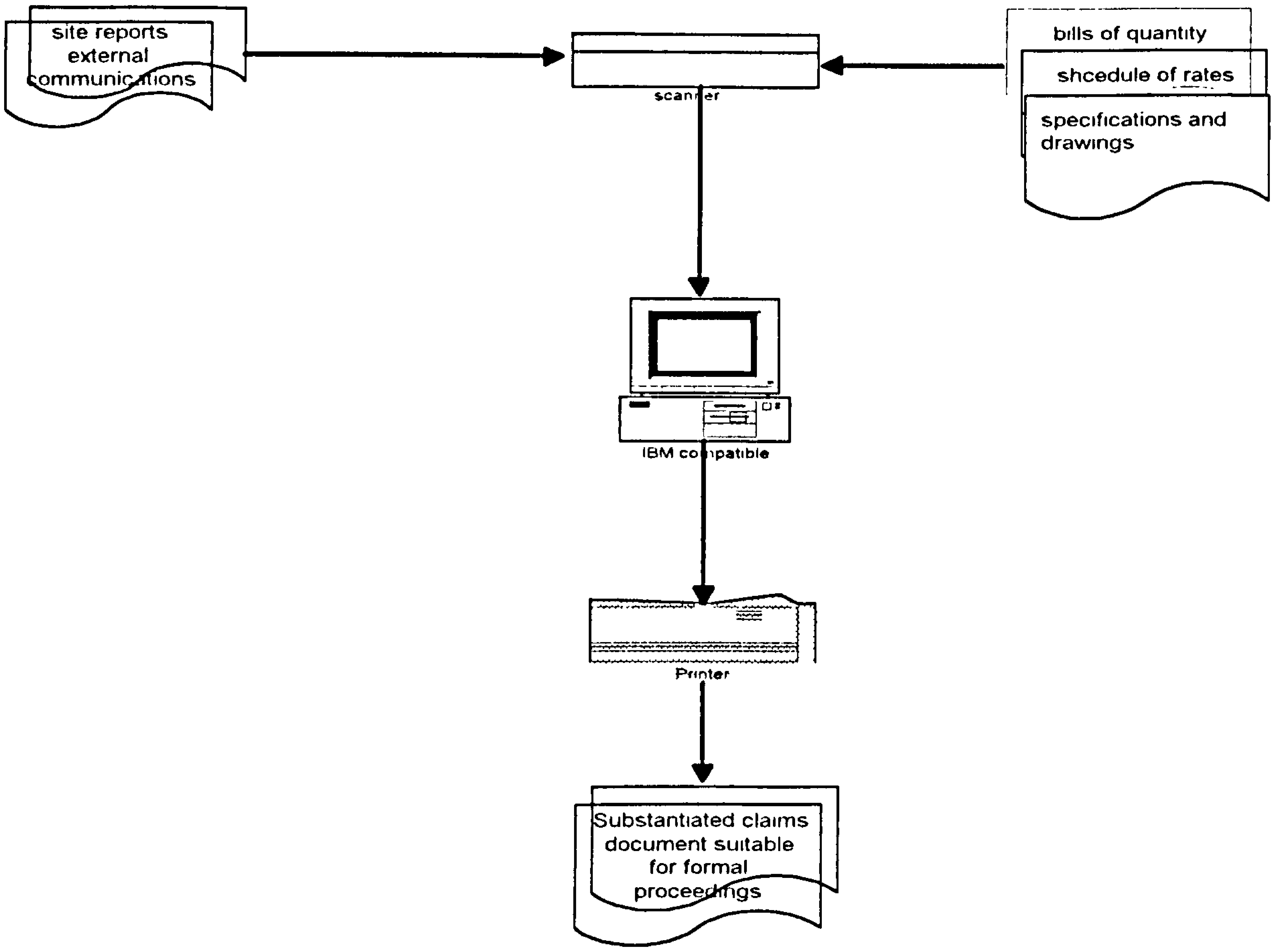


Figure 10.1: A simple Electronic Document Management System for Claims

These systems are capable of integrating documents from all the sources of information (Chapter Seven) required for the preparation and evaluation of claims. For example, the Quantity Surveyor can extract the actual deployment of labour on each activity from timesheets, update resource usage in the detailed schedule of works without having to re-key in the data from the a keyboard. This will enable the him to link increased resource usage attributable to disruption or delay. He will then be able to prepare a detailed claim documentation based on these records for settlement soon after the occurrence of the event. This functionality was absent. from earlier systems reviewed in Chapter Eight (§§8.2.2.2).

10.3.2 Computer Output Laser Disk (*COLD*)

Historically, computer generated reports were composed from data records which are printed out, but not kept on the system as a document. In this situation, so long as data remained unchanged there was a chance that the document could be recomposed. However in real life, the data is frequently updated or changed in some way so the printed version became the '*original*'. The cost of keeping reports on computer disks for subsequent viewing was uneconomic and operationally impractical, so the reports or printouts had to be kept and filed as the only retained copies. This is one reason why the earlier DIP systems were not widely implemented in industry compared to EDMS.

The introduction of laser disks in the mid 1980s changed the economics radically. These new devices offered huge storage capacity with lower cost per megabyte but were intrinsically a better medium than magnetic disks. With access times of around 10 seconds, the medium has been adopted for electronic document management. Computer Output to Laser Disk therefore came to mean that 'computer output to printer' was mirrored by copies being sent to laser disk or *COLD*.

This terminology can be confused with references to optical disks which use the same laser technology. In this chapter COLD relates to both systems as classification by sizes is a matter of capacity, cost and speed of retrieval. Generally, the developments in this technology have produced three types of laser disks which are used with EDMS. These are:

- *CD-ROM* - Compact Disk with Read Only Memory, where information is pressed onto the disk in a manufacturing process similar to audio CDs;

- *WORM* - Write-Once-Read-Many where the disk can be written to by a computer but the information cannot be overwritten. These are generally preferred when it is essential to retain information for a considerable length of time;

- *ReWritable* disks similar to WORMs which can be written to many times in much the same manner as magnetic disks.

COLD therefore refers to new storage mediums using laser disks with large storage capacity.

10.3.3 Text Retrieval

Text Retrieval differs from Document Image Processing in that, the former do not hold documents as images. In text retrieval systems users had to search and retrieve information by keyword or phrase, using logical operators, wild card and phonetic searching. The retrieval of the document therefore depends on its content and can performed over records, databases, word processed and spreadsheet files and all forms of machine readable data. This functionality brings the capabilities the traditional text retrieval systems (§§**8.2.2.2**) into electronic document management.

10.4.0 Types of Systems Available

A whole spectrum of generic systems for electronic document management have emerged on the market. Three main categories can be identified [227]:

- Dynamic Document Management Systems;
- Document Image Management Systems;
- Document Exchange Programs.

10.4.1 Dynamic Document Management Systems

Sometimes referred to as ad-hoc document management or Workflow systems, these focus on managing documents that are still in creation, being edited or in production stages.

Dynamic Document Management Systems have four basic functional elements [228, 227]: (i) to enable the user to design the Workflow once the key processes have been identified and mapped; (ii) to integrate with existing sources of information and task-support systems; (iii) to manage the flow of work tasks by delivering the right information to the user or group and passing work on when completed; and (iv) to provide management with information so that it can control the flow of work. From the writers' experience, these systems are suitable for well structured tasks requiring high volume processing. For example, in construction the preparation of Bills of Quantities which involves the valuation and estimation departments of a construction firm can be managed very effectively by such a system.

10.4.2 Document Image Management

These focus on the management of documents that are already complete, making content creation and formatting easy. Document Image Processors permit the assimilation of documents from external sources as electronic documents. For example, some of the latest Estimating packages which are now used by some major construction firms apply this technology to enable Bills of Quantities to scanned and used for estimation and valuation.

10.4.3 Document Exchange Programs

Document Exchange Programs focus on making electronic documents more portable. Aiming to reduce the handling of paper documents by using formatted electronic versions that the user can open and print in different applications.

10.4.4 All purpose Systems

It is important to recognise the wide range of input sources for electronic document management systems. EDMS is often associated with scanned images of paper documents but the latest systems on the market now enable the easy inclusion of documents from a variety of sources: (i) from paper documents via scanning equipment; (ii) from microfilm and microfiche via special scanners; (iii) from PC systems such as word processing (WP), spreadsheets or desk-top publishing (DTP) via electronic input; (iv) from data processing applications, for example pay advice, invoices, schedules of rates and a many more via electronic input.

Although solutions exist for each of the application areas, experience has shown that to meet most business requirements the approach is the adoption of an integrated document management system. The major benefit being the creation of a comprehensive, computer-based repositories with effective storage and retrieval facilities. The general purpose systems profiled by Stevenson [226] are eloquent examples of integrated packages.

10.5.0 Integrating Information Sources Using EDMS

Five main functional departments within the construction organisation generate information required in the preparation and evaluation of claims (Chapter Seven). These are, accounting, planning, valuation, estimating and cashflow forecasting. The dependence of these functions on information generated by each function and the poor interface that exists for accessing such information which has been the subject of much research highlighted notably by the work of Ndekugri and McCaffer [158] has been emphasised in Chapter Eight (§§**8.1.0**). This dependency naturally extends to claims management as a new and emerging construction management function where these sources are additional to site activity data accumulated during the currency of each project. In general the sources of claims relevant information can be categorised as, site reports, in-house cost reports, communication with clients agents and general project documents (Chapter Seven).

From the case studies reported in chapter seven, two main formats of information were identified (§§**7.0**): paper and electronic. The electronic data was usually generated within the construction firm while the site reports are paper-based.

The paper-based site reports can be captured via imaging technologies and electronic ones such as project cost data can be imported by any EDMS system (§§**12.2.0**). This allows all files to be stored in their original format and viewed before retrieval. Data from these files can also be exported to the original application for editing and version control. Progress data from weekly or daily activity update forms, can be used in this way to update the programme of work thereby removing the need to key in the data manually (Chapter Twelve).

In addition, the information sources which are not viable for conversion to electronic format can also be managed using other functions of EDMS packages. Physical items such as books, site diaries, archive boxes can be stored, tracked, retrieved and disposed of as appropriate using one of these technologies. The management of all these varied sources of information is possible as a result of advances in automatic data capture which has accompanied the emergence of EDMS.

10.5.1 Automatic data capture

There a number of these technologies associated with EDMS that compliments keyboard data entry. These include bar coding, optical mark recognition(OMR), optical character recognition(OCR) and intelligent character recognition(ICR).

10.5.1.1 Bar Coding

The use of bar coding is well established in records management primarily as a means of tracking physical files. It is also a major source of data capture for incoming images either via scanners or facsimile. They can be used to identify file numbers, document types and the like with a very high accuracy.

10.5.1.2 Optical Character Recognition (OCR)

OCR is the conversion of typed text from an image into machine readable form such as word processing files. The *OCR* data has enormous benefit as a supplement to the index of documents already held in a database. It enables searches of the entire document and not just the text in the index.

OCR error rates depend on the quality of the document being read. New documents can be read with greater success while older, damaged or hand-written documents can present problems.

10.5.1.3 Optical Mark Recognition (OMR)

OMR technology can detect whether a mark for example an answer to a multiple choice question, or signature exists in a specific area of a form.

10.5.1.4 Intelligent Character Recognition (ICR)

ICR is the conversion of hand-written characters, usually in constrained boxes into machine readable data. As with OCR this technology has the ability to supplement indexes held in a database and is ideal for lifting data from forms such time sheets and site reports.

10.6.0 Possible impact of electronic document management systems

A recent survey sponsored by the Document Management Suppliers' Group [228] revealed that the five main factors listed by potential users for implementing these systems in order importance were: (i) faster task completion; (ii) improvement of quality; (iii) cost reduction; (iv) reduced storage space; (v) shortened time scale for processes.

The above factors have very important implications for the construction industry. The reliance of most construction firms on paper-based systems is epitomised by the difficulties experienced in the management of an information intensive function such as claims preparation and evaluation. In the context of construction claims management the main benefits of implementing EDMS solutions will be in:

- the speedy preparation of claims documentation;
- reducing cost of claims preparation;
- efficient access and retrieval from all claims-relevant information sources;
- access to information across functions and applications.

10.6.1 Speedy preparation of claims

The ability of the contractor's Quantity Surveyor to establish entitlement for any claim depends not only on the narratives often cited in claims documents but on an account of events on site based on the examination relevant records. Since these records are mostly paper-based the time and cost required to identify and retrieve the pertinent documents to make any form of assessment is considerable (Chapter Six and Seven).

Take the case of a contractor attempting to show that the piecemeal release of design information by the consultant delayed and disrupted the regular progress of works. For a start, he has to establish the dates on which these were due and when they were received. Request for information (RFI) and other communication with the designer which are needed to support this claim could be buried with hundreds of other documents related to the project.

Time has to be set aside to leaf through these files to retrieve each of these documents for evaluation of the facts. This is often not viable compared to the value of the claim. The consequence is the use of cost summaries (Chapter Seven). EDMS posses the functional capability to undertake this process in a fraction of the time and cost this process currently involves. In view of the diversion of resource that this task often requires the use of EDMS will in the medium to long term lead to considerable cost savings .

10.6.2 Improved quality of claims documents

One of the criticisms often levelled against contractors is that the information provided as a basis for entitlement is wanting in terms of detail and/or availability (Chapter Six). The dilemma for the contractor in this regard is that the cost of retrieving the required information such as resource allocation on project activities affected manually from the paper records is high (Chapter Seven). For all the will he might have the resource requirement does not often make it viable in relation to amount claimed. The contractor consequently, prefers to make general claims and retrieve the required detailed information only when compelled, sometimes years after the event (§§6.4.0 and §7.0) or use the global claims technique which the law suggests may not be acceptable (Chapter Three) and is not favoured by consultants (§§6.5.0).

Collecting evidence of this kind is possible with most of EDMS packages on the market. The presence of all the relevant project records in an electronic document management system with form reading capability can automate the retrieval and information evaluation process identified as crucial in the decision making process in claims management (Chapter Five).

10.6.3 Access to information across functions and applications

Apart from site reports on which claims preparation relies, sources such as in-house cost reports and rates are important in the quantification of claims (Chapter Seven). The difficulty for the contractor is that, very often each functional department maintains its own data base structured to suit its particular needs. Using data from other functions thus required the data to be reformulated. This lack of adequate interface means that for certain data such as materials, cost data have to be dealt with in the form of hard paper copies. With the advent of ***COLD*** as part of EDMS, access can be provided across functions and applications to all documentation within the construction organisation allowing retrieval regardless of format.

10.7.0 Replacing the paper-based system

The simplest application of EDMS on a small scale for managing claims is where the system is used to replace the paper-based filing of project documents. Although basic, it illustrates the concept most vividly. The main components are: (i) ***computer*** - screen, memory, disk storage and operating system with links to central storage; (ii) ***document scanner*** : to allow original documentation to be scanned into the computer ; (iii) ***printer*** : to enable copies of the original document to be made (iv) ***application software*** : to allow the scanned documents to be manipulated at as well as the paper alternative. The Document Management Resource Guide [229] provides a list of some of the well known product on the market.

10.8.0 The Role of EDMS in an Integrated Computer-based System

The review of computer applications which are used in aspects of claims preparation especially quantification (Chapter Eight) and justification (Chapter Nine) concluded that the utility of such systems are severely hampered in practical terms because they do not provide access to the range of information sources needed for claims management. The essential application that can enable an integrated IT solution to be designed is the EDMS.

The initial model for a system capable of integrating the various applications required to facilitate claims management has been proposed [230]. Figure 10.1 illustrates the conceptually the main components of a system for claims management. The vital interface required to implement a practical system will be provided by an EDMS.

10.9.0 Summary

Electronic Document Management Systems offer the construction organisation a tool to efficiently manage claims by reducing the time and cost of retrieving claims relevant information. Thsi tool can integrate all information sources regardless of format and thus improve the quality of claims documentation.

It is therefore a tool which those concerned with finding ways to speed up the adjudication of disputes, cut cost of projects should seriously consider as part of the wider drive towards the delivery of project in a cost efficient manner.

CHAPTER ELEVEN

AN INTEGRATED COMPUTER-BASED SYSTEM FOR CLAIMS MANAGEMENT

11.1.0 Introduction

The examination of the nature of the claims management process and case studies (Chapter seven) suggests that communication is a fundamental problem. The review of general application software (Chapter Eight) indicated that, database systems and spreadsheets can be used in claims quantification while Chapter Nine pointed to the potential for using expert systems in claims justification and to some extent quantification. The latter can be achieved through the use appropriate interfaces with spreadsheets or database systems. The main drawback of these applications was the necessity for manual entry of data in almost all instances. However, because most of the sources of information on which the claims management process depends are paper-based and/or in different electronic formats, considerable reprocessing was required in order to use them. To resolve the problem of access at the data exchange and document access levels, Electronic Document Management Systems technology was identified as capable of providing the vital interface to these sources of information (Chapter Ten).

However, these problems can only be overcome through integration. As part of proposals to improve claims management a general integrative model was developed. Although it may not be possible to implement immediately, it will be very useful as a long-term goal within which current decision making can take place.

This chapter describes the development of the model. The model outlines the functional requirements of an integrated system based on the findings of a structured systems analysis using the SSADM methodology. This is the structured systems analysis methodology recommended in the UK [232, 233].

This chapter also includes the results of process investigation in the form of data flow diagrams. The diagrams describe the logic of the claims management process, data flow between functions and processes involved in the preparation of claims. This is preceded by a description of the outcome of the normalisation of claims relevant records obtained during the case studies. The expert system component prototype which was developed and tested internally is briefly presented followed by the examination of the implementation implications of the integrated computer-based model.

11.2.0 Normalisation and rationalisation of claims relevant documents

Normalisation is a process used in the design of computer systems to transform data into natural groupings such that one fact or data is in one place and the correct relationships between facts exist. This process is used in relational database design to implement new and improved records for organisations to construct database systems was applied to all the samples of site records obtained during the case studies (Chapter Seven).

The result of the normalisation showed that some of the site documents were redundant while the rest could be simplified. This finding formed the basis of some of the proposed documentation set out in Chapter Twelve (§§**12.3.0**) as part of an overall strategy to allow easier data capture for claims management. Table 11.1 is an example. This shows the normalisation of Site Daily Report.

Table 11.1: The normalisation process of a site record

UNF	FNF	SNF	TNF
Serial No.	Serial No.	Serial No.	**Project Details**
Contract	Contract	Contract Name	Serial No.
Engineer	Engineer	Location/Section	Contract Name
Location/Section	Location/Section	Weather	Location/Section
Day	Day		Weather
Weather	Weather	Serial No.	
Date	Date	Contract Name	**Contractor**
Labour		Engineer Name	Serial No.*
No.	Serial No.	Day	Contract Name
Total Man-hours	Date	Date	Day
Plant	Particulars		Date
Type	Details	Contract Name	
Total hours	Inspected by	Engineer Name	**Engineer**
Particulars	Agent	Date	Contract name*
Details	Signature	Particulars	Engineer Name
Inspected by		Details	Particulars
Signature	Date	Agent	Details
Agent	Labour No.		Designation
Comment	Total Man-hours	Engineer Name	
	Plant type	Date	**Site Agent**
	Total Hours	Labour No.	Engineer Name*
		Total Man-hours	Date
		Plant Type	Agent
		Total Hours	
			Resource Allocation
			Date*
			Labour No.
			Total Man-hours
			Plant Type
			Total Hours

The normalisation of all the other claims relevant records are in Appendix 2.

11.3.0 The Structured System Analysis

Based on the initial examination of the various external entities that interact with the claims management process the context diagram in Figure 11.1 was derived.

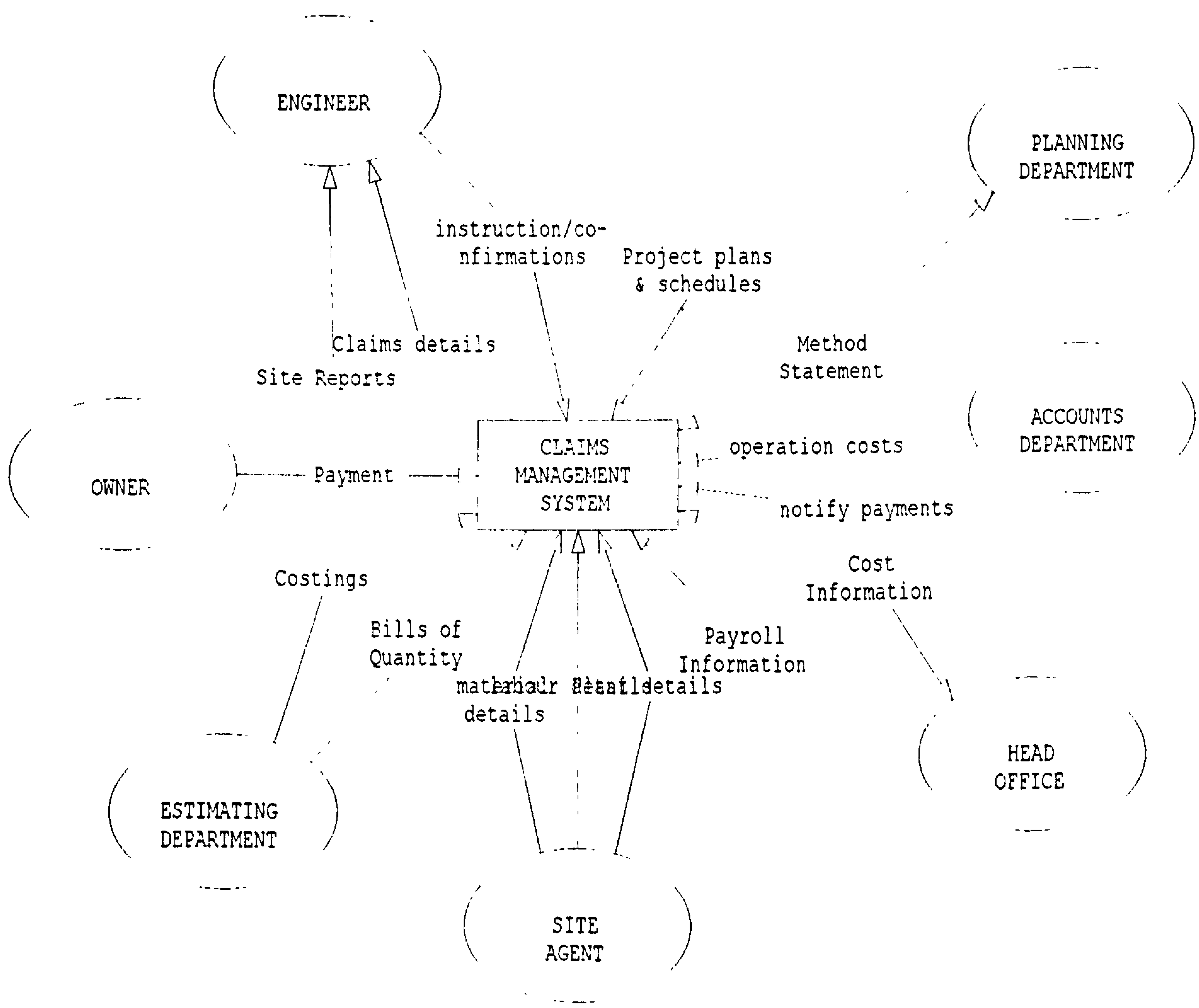


Figure 11.1: The context diagram for the claims management system

The diagram (Figure 11.1) shows the claims management system interacting with a number of external entities which receive and/or transmit information to the system as identified in the case studies (Chapter Seven). These are, the Architect (or engineer), the owner, head office, site agent, sub-contractor and the planning, estimating and accounting departments. The data/information that these entities receive from and transmit to the system as shown in Figure 11.1 are tabulated in Table 11.2. The context diagram re-emphasises the need for the system to interface other functions in the construction organisation.

Table 11.2 : The data / entity matrix

External Entity	**Data/Information sent or received**
Site agent	1. Plant details 2. Materials details 3. labour details
Onwer	1. Cheques
Engineer(A/E)	1. Instructions 2. Site reports 3. Claims details
Head office	1. Payroll information 2. Cost Information
Accounts department	1. Notify payments 2. Operations cost
Planning department	1. Method statement 2. Project plans and schedules
Estimating department	1. Bills of quantities 2. Costing

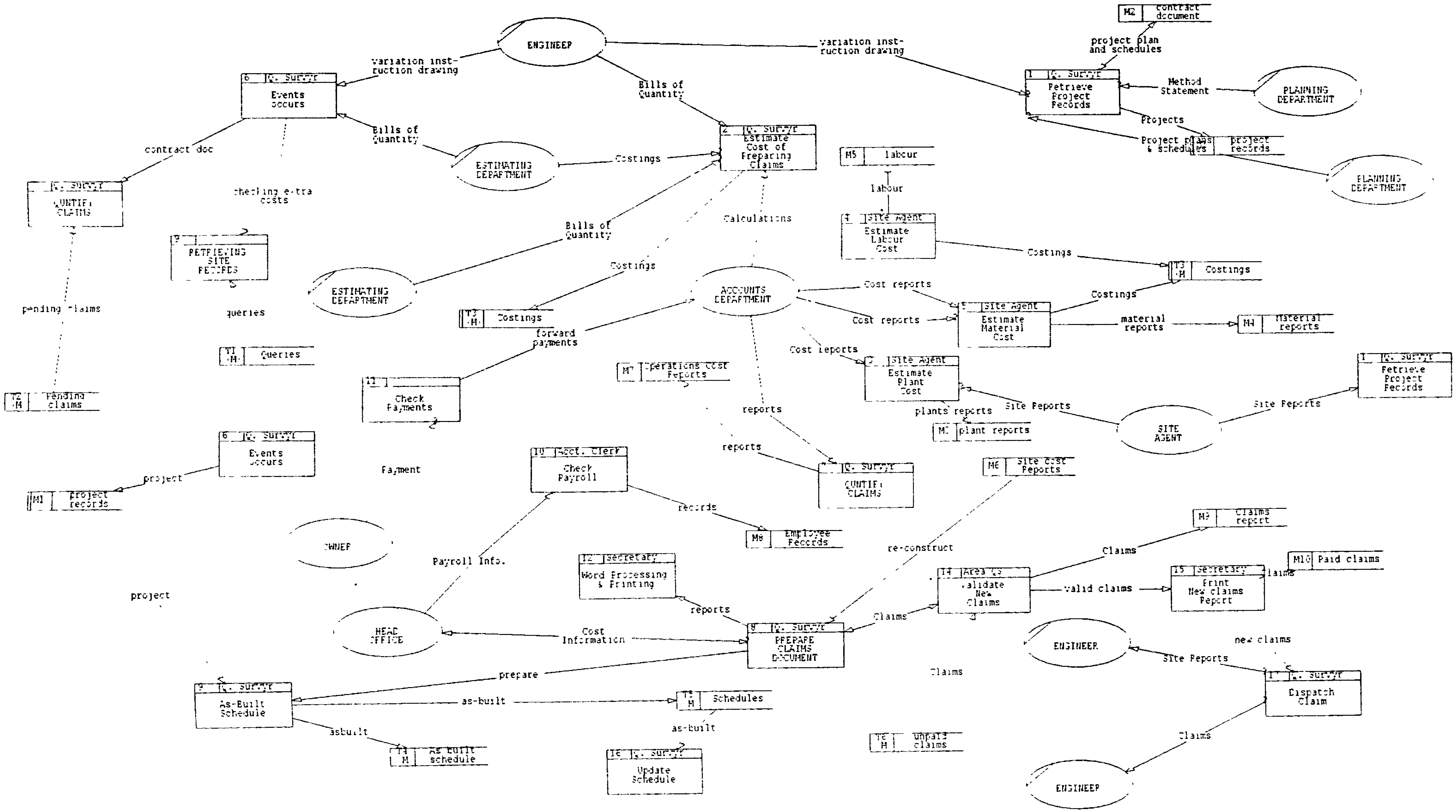


Figure 11.2: The current physical data flow diagram

After deriving the context diagram, the current physical system of claims management was produced as shown in Figure 11.2. The physical system identifies all the processes involved in the claims preparation process based on the explanations given to the author by the QSs and their superiors in charge of the case studied. The combined perception of the process is what is represent in Figure 11.2.

Based on the physical data flow diagram which represent actual claims management as observed and through interviews of QS during the case studies the logical data flow diagrams (DFDs) were constructed to rationalise the identified processes and data stores in the physical system (shown by figure 11.2).

11.3.1 The Logical data flow Diagrams

After rationalising the processes in the current physical DFD, four main processes were identified. These are, legal evaluation, quantify claim, preparing claims documentation and forwarding the claim. The processes and the data they receive and transmit to other processes and entities are illustrated by the level 1 DFD shown in Figure 11.3. The lower level (level 2) processes for legal evaluation are illustrated by figure 11.4.

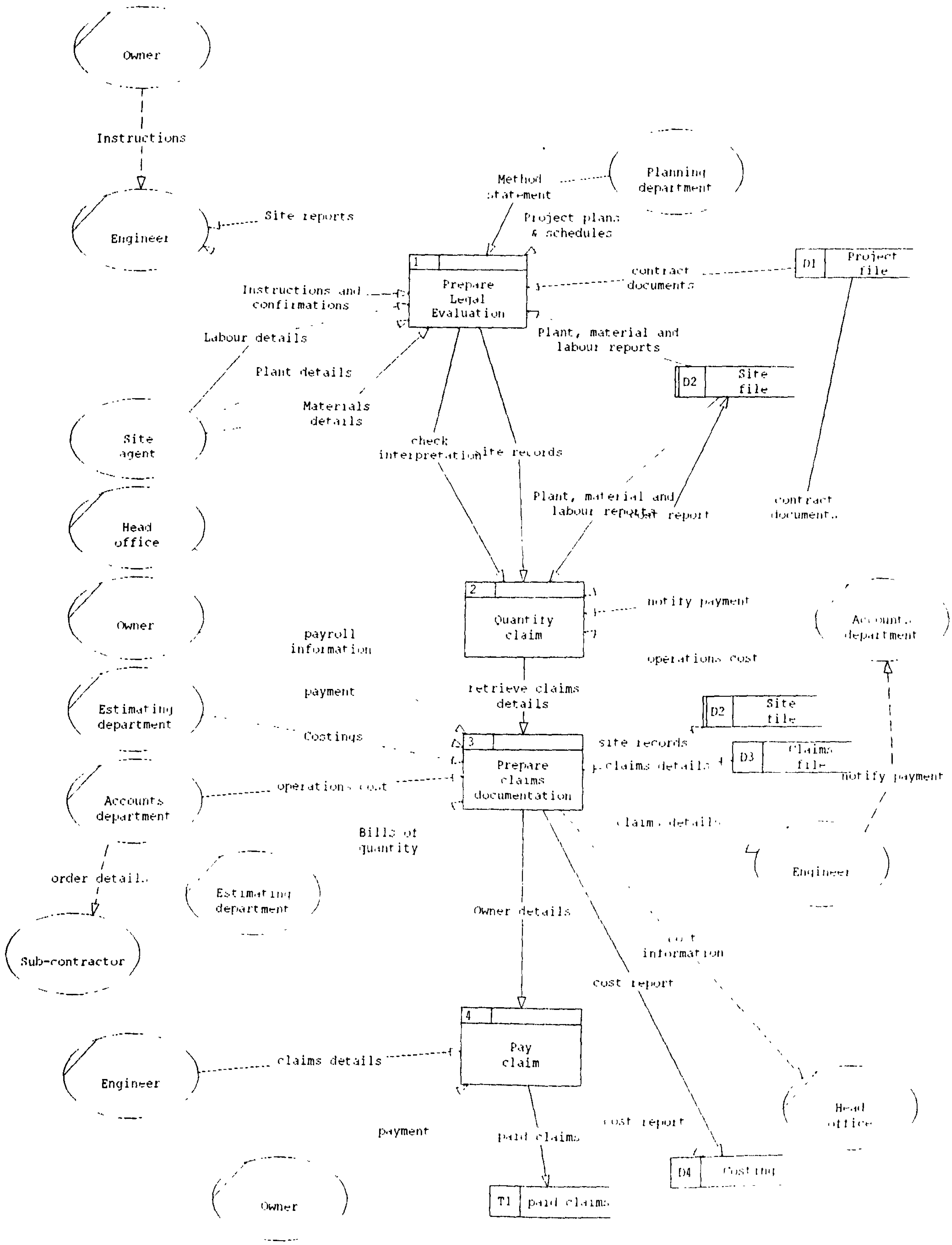


Figure 11.3: Level 1 Data flow diagram

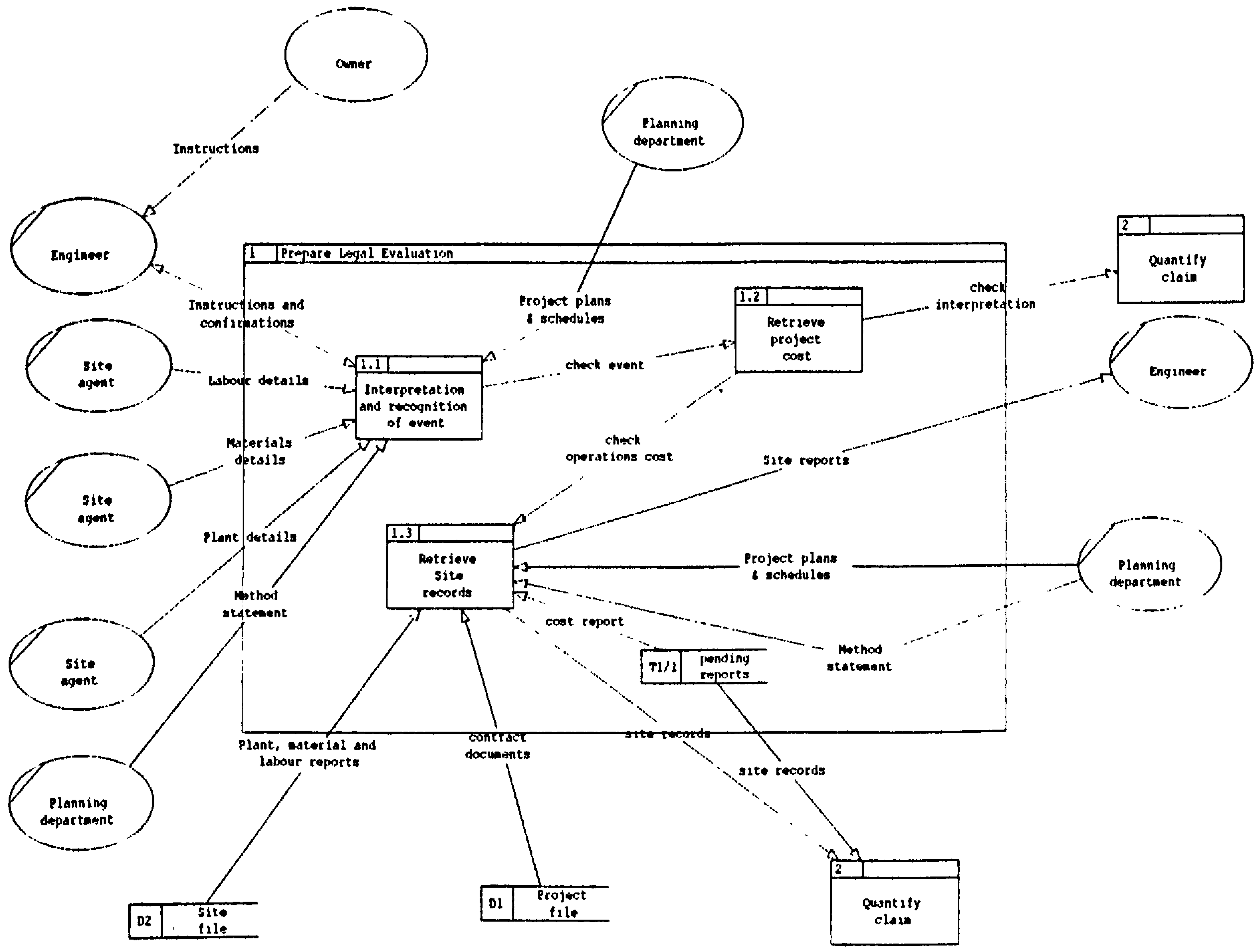


Figure 11.4: Level 2 Data Flow diagram For Legal Evaluation

Figure 11.4 shows that legal evaluation process involves the QS interpreting and recognising the occurrence of an event for which a valid claim can be made. Accessing information from the Site agent, Engineer, planning department, the event is recognised by imposing the facts on to the terms of contract. Here case law and project records (in the project file) are used. The result of this process is checked and data on the project cost is retrieved to estimate the impact of the event on particular project activities. This is followed by the retrieval of site and project records from data stores D1, D2 and T1/2-pending report shown in figure 11.4.

The level 2 DFDs for quantify claim is shown in Figure 11.5. The quantify claim process, involves the calculation of the initial estimates for each heads of claim with data from the accounts department. To check this estimate, labour, the plant and material reports from the site file (D3) are retrieved.

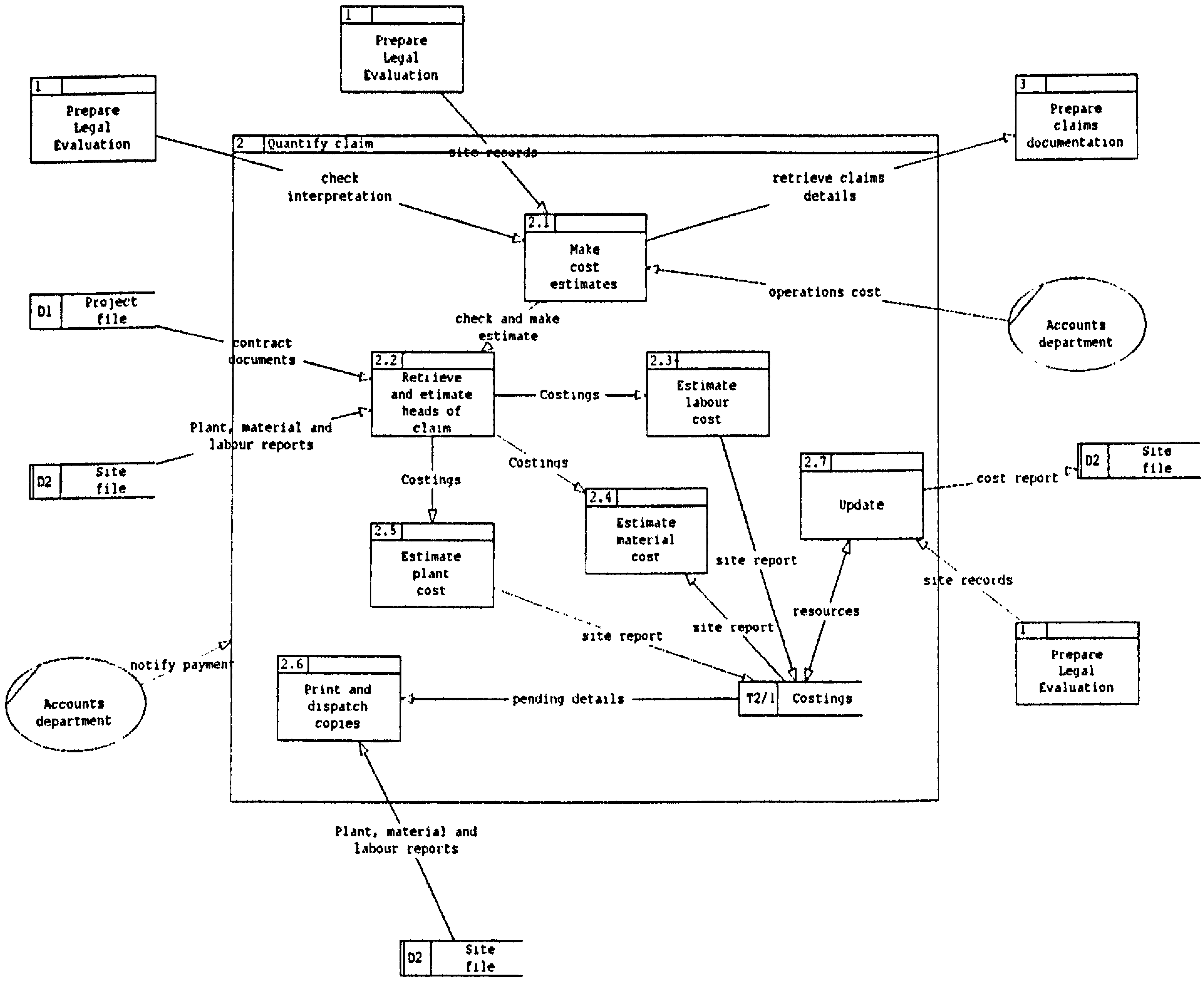


Figure 11.5: Level 2 Data Flow Diagram for quantify claim process

The cost data resulting from this process is kept in the transient data store (T2/1) ready to printed, dispatched or updated to be kept on the site file. These records can then be transmitted to the legal evaluation process to validate them.

The level 2 DFD for preparation of claims document is shown in Figure 11.6. In the claims document preparation (Figure 11.6), the details of the claim generated from the quantification process is retrieved and checked. The as-built schedule is prepared from original schedules retrieved from transient file T3/1 followed by the processing of a claims report. This report is placed in the transient file T3/2 (unpaid claims) which is subsequently sent for printing and then dispatched to the engineer with copies in the claims file.

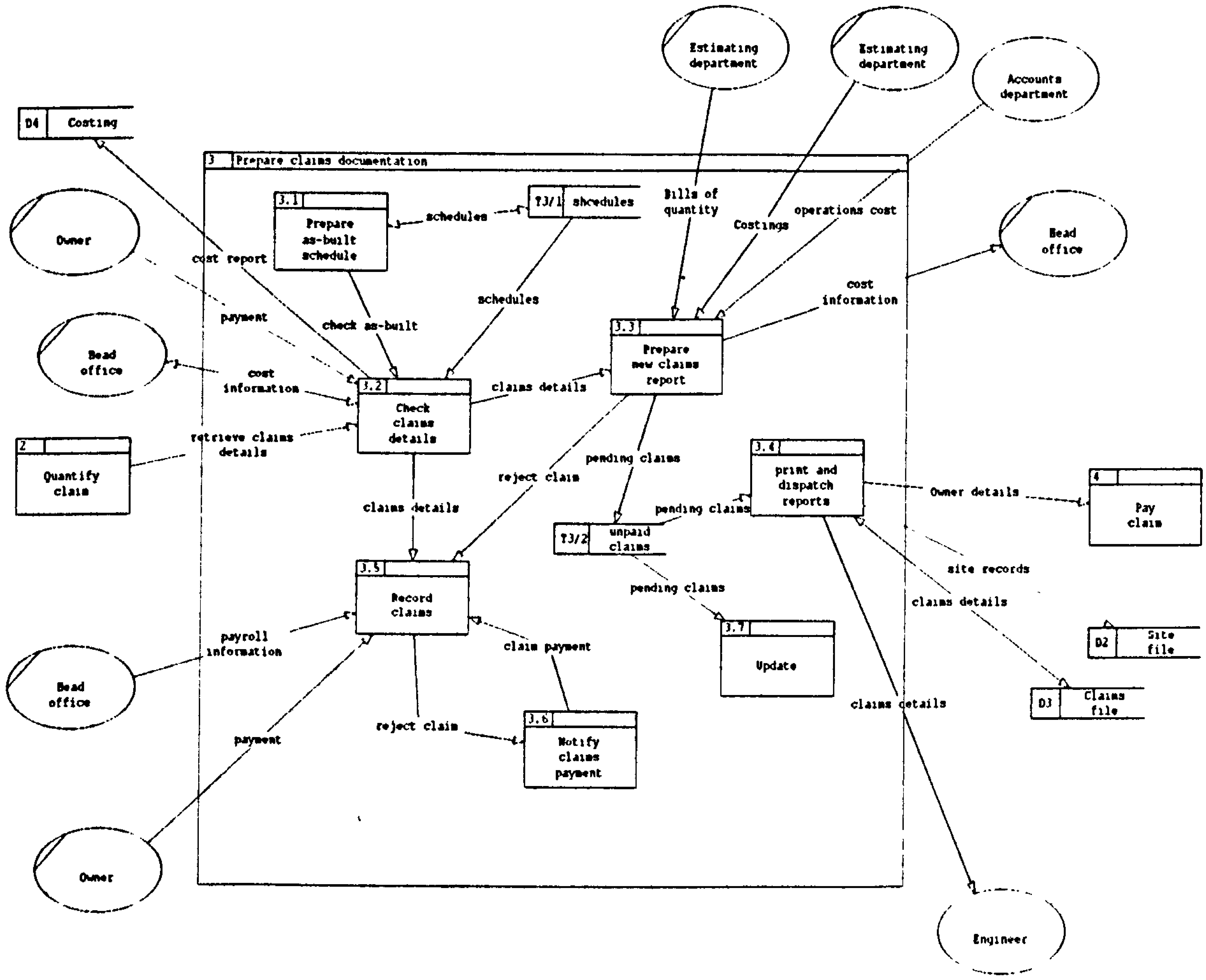


Figure 11.6: Level 2 Data flow diagram for Preparation of Claim Documentation

11.3.2 The Entity Relational Diagram

Using the result of the normalisation process and the logical data flow diagrams, the entity relational diagram (ERD) which represents at the physical level the relation between all entities was derived (Figure 11.7). The ERD as it stands represents in essence the structure of the relational database than is required to support the claims management system at a data level.

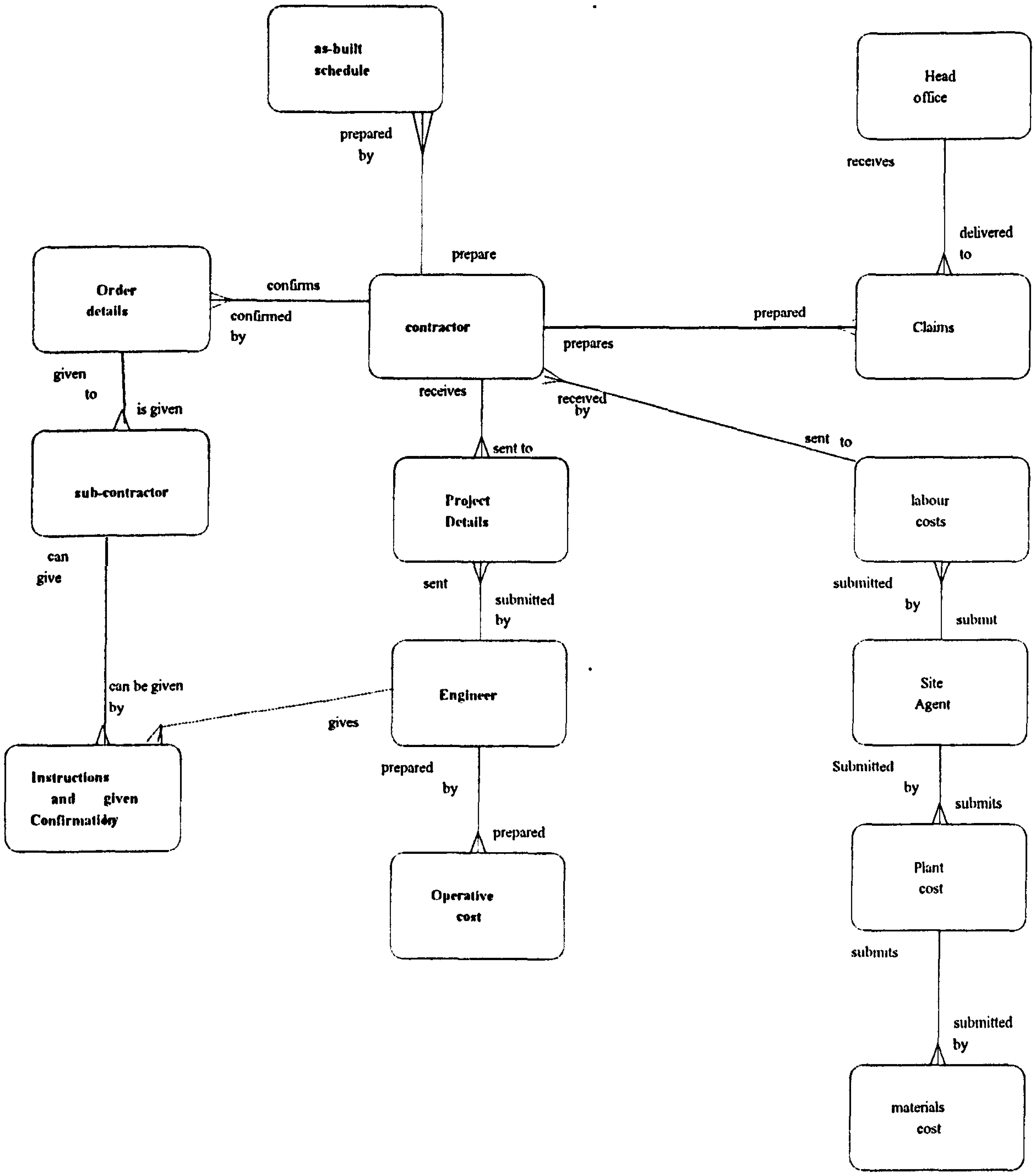


Figure 11.7 The Entity Relational Diagram

11.3.3 Menu Structure of System

Based on the processes identified in the preceding sections of this chapter, the following menu structure for an integrated system for claims management was developed (Figure 11.8).

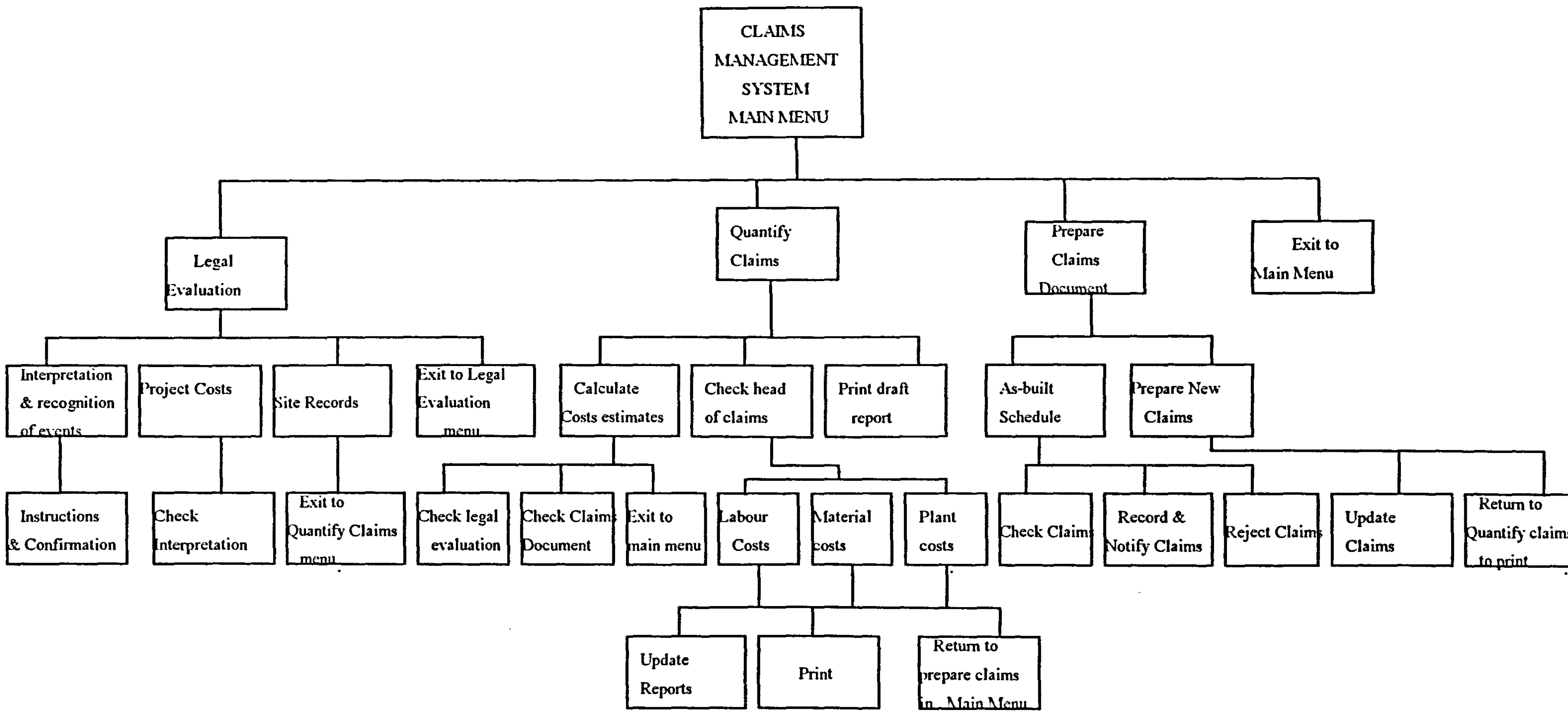


Figure 11.8: Claims Management System Menu Structure

11.3.4 Functional Requirements

Based on the analysis of the processes for preparing and presenting claims, and the results of the normalisation of claims relevant documents from which the menu structure was designed (§§11.3.5), the system for claims management has four main processes: Preparation of legal evaluation, quantify claims, prepare claims documentation and forwarding claim.

11.3.4.1 Prepare legal evaluation

In this process, the user evaluates the provisions of contract by interactively examining the set of events which might be grounds for claims under a contract. Here, the events for which reimbursement is being sought are related to contractual provisions to ensure compliance with procedures and determine that the said event are covered by the consequence, based on the examination of site reports would be an escalation of cost and time of a particular activity. This process includes four main functional elements: (i) the interpretation and recognition of events; (ii) retrieval and evaluation of instructions and confirmation of instructions; (iii) retrieval and evaluation of project activity cost; (iv) retrieval and evaluation of site records.

11.3.4.2 Interpretation and recognition of events

This process should enable contractual provisions to be interpreted using case law and the facts surrounding any alleged delay or disruption for which the claim is being made. During this process, access should be provided to planned schedules, updated schedules, contract documents and site reports to determine the validity of the claim

11.3.4.3 Retrieval and evaluation of instructions and confirmation

This involves the retrieval and evaluation of all instructions or correspondence related to the delay or disruption. Documents retrieved are examined to confirm the claim can be substantiated.

11.3.4.4 Retrieval and evaluation of project cost/site reports

The requires the generation of cost reports from project records on each scheduled activity to indicate the cost and time impact of a particular event.

11.3.5 Quantify claim

This requires access to site reports and contract documents. This process enables the system user to estimate each head of claim. This requires access to labour, plant and material records to quantify them. The retrieval of site records, management records from the accounts department for example to estimate management cost and to estimate each head of claim with reference to each project activity.

11.3.5.1 Preparation of claims document

This is where all supporting documentation needed to justify the estimated in the quantification is assembled. The process includes the preparation of the as-built schedule to demonstrate the effect of an event(s) on the sequencing of works, check the claim detail, printing and dispatching the claims documentation.

11.3.5.2 Forward the claim

In this process, the claim is checked and dispatched to the engineer.

11.4 The Conceptual Computer-based Model

The result of the review of the existing generic systems (Chapters Eight and Nine) suggests that some are used for aspects of claims management on a stand alone basis. However, the results of the structured systems analysis in the previous sections of this chapter suggests clear need to integrate these systems in order to achieve the functional requirements set out in **§§11.3.6**. Such an integrated system will allow not only the performance of the usual contract administration functions but also support the evaluation of contractual claims by permitting access to information generated by the contract administration process such planning estimating and accounting.

Conceptually, the integrated computer-based system (defined by the functional requirements and menu structure in **§§11.3.5**) should incorporates the functions of widely used application software in order to provide a flexible tool for the management of claims. The relationship of these generic software and the information they process within an integrated model are illustrated by Figure 11.9. The model shows the range of applications that can be used in such a system but a practical system would exclude some applications as some perform the same basic functions. For example, the database and spreadsheet applications can handle the mathematical aspects of the quantification process described in **§§11.3.4.2.** An expert system can assist in the justification process under the legal evaluation function (**§§11.3.4.1**).

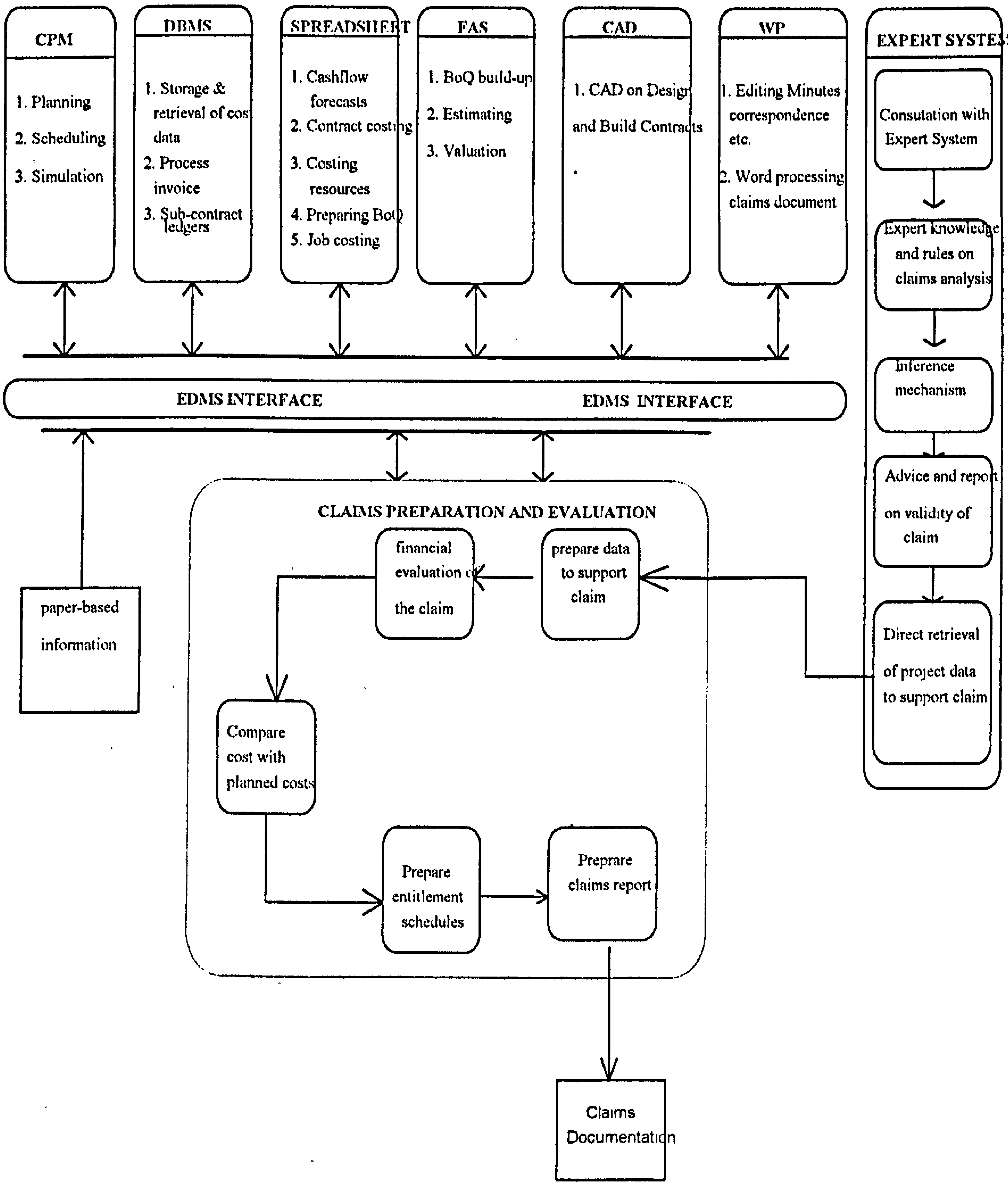


Figure 11.9: The conceptual computer-based model

The role of each item of the generic software will therefore be their usual functional role in the contracts administration process but with a suitable interface designed to allow the use of data processed by each system to be available to others thereby, reducing considerable duplication of effort in the re-keying in of information at each stage of the claims management process.

The model thus takes into account, the varied nature of information required to undertake the three key aspects of the claims evaluation process illustrated by Figure 5.5. The adoption of an integrated approach is supported by recently reported prototypes. The trend in the design of systems that adopt of an integrated approach to take advantage of other management tools. For example the expert system reported by Diekmann and Kim [218] dubbed *SuperChange*, supports a comprehensive hypertext-based, context sensitive help system, court citations, relevant dicta and a report writing capability. That reported by Riad, Arditi and Mohammadi [222] interfaces a database management system and a spreadsheet while that of Alkass, Mazerolle and Harris's system [219] analyses delays by interfacing with a CPM package.

The concept of this integrated model is to offer access at two levels: data interchange and document interchange. The data interchange level for example between the database containing rates and resource scheduling module in a CPM package for the evaluation of the impact of site events on project costs. Document interchange refers to the ability to view documents originating for other applications while performing tasks. For example, it may be necessary for the QS to examine instructions while answering a question in the expert system module on whether the instruction was a basis for making a loss and/or expense claim where the project is delayed or disrupted. In this model the functionality required for such access makes an EDMS interface vital. The reasons for using this technology were discussed in Chapter Ten (§§**10.3.0**).

11.4.1 Implementation Implications of the Model

The software systems described in Chapters Eight, Nine and Ten are implemented in a wide range of hardware/software environments. If they are to be incorporated as sub-systems of the proposed system the question of compatibility has to be addressed. Although considerable progress has been made in the area of hardware compatibility, facilities for communication between the various software systems are still, at best, very rudimentary.

The problems raised by the lack of software compatibility concern the required expertise of the system's intended user and the data transfers across systems. Firstly, as the information requirements of a typical claim are scattered across the sub-systems the user would have to possess, at the very least, a fair understanding of the all these sub-systems. This knowledge would be additional to knowledge of construction methods and technology and construction law. The second problem is that, even assuming sufficient knowledge of the various systems, data transfer from one application to another, e.g., from a CPM software to an expert system, is cumbersome. With the current state of the software market, printing from source system and inputting into the target application would be required in most cases. However, with the recent alliances to establish protocols for Application Program Interchange (API) this problem is largely resolved. Therefore with further programming the integrated system can be delivered.

The level of abstraction of the proposed expert system component is also a fundamental question. To appreciate the pivotal importance of this issue consider decision-making in the assessment of a claim for extension of time. At a high level of abstraction the decision-making would be as shown in Figure 11.10.

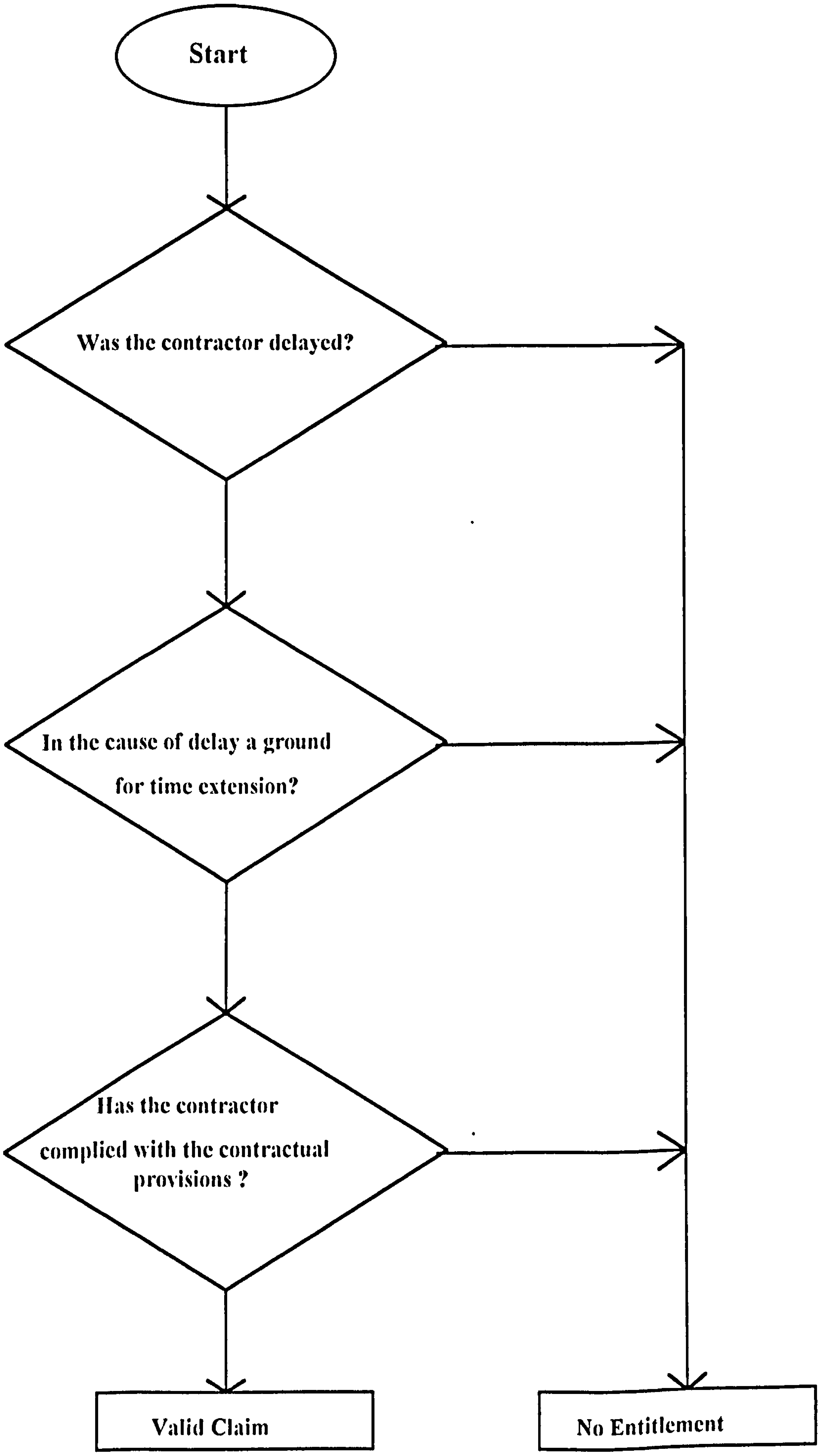


Figure 11.10: Levels of abstraction

Although this level of abstraction makes for ease of development of the sub-system, the resultant system would carry little credibility with the intended users because it oversimplifies the actual decision-making involved. In practice, the issues involved in answering the question "Is the cause of the delay a ground for extension of time?" would range from the identity of the individual contractual grounds for extension of time to the considerations of circumstances in which it could be said that what has happened is a particular event provided for in the contract. Such detailed consideration could be expert system applications areas in their own right.

The abstraction issue is also related to the issue of the expertise of intended users because the higher the level of abstraction the more decisions that have to be made without any assistance from the system. This has implications for training in the use of the system and for change in the organisation of the way claims are dealt with. The more the expertise required of the user the more likely that the user will have to be shared among projects. This may mean the user being office-based and having adequate access to relevant project information by some form instantaneous site-office communication channel.

In this situation, the effectiveness and efficiency of communication within the construction organisation and with other members of the project team are of prime importance to the settlement of claims. Technology and related software already exist for improving both types of communication, e.g., electronic mail, Local Area Networks, Wide Area Networks and Valued Added Networks. The preceding discussions highlight only too clearly the prime importance of communications technology to a practical application of the model. However, the construction industry's awareness and use of this technology is very far from satisfactory. A recent survey of UK construction organisations reported by O'Brien and Al-Soufi [235] disclosed that generally there was inadequate exploitation of the technology by mainstream contractors and firms offering professional services. The small number of respondents who indicated anything near sufficient awareness or use were mainly manufacturers and suppliers of products to the construction industry.

11.5.0 The Expert System Module

Due to limited computing resources and constraints of time only the expert system model of the integrated system for the claim justification process was developed. The development process and the results of tests are described in this section.

11.5.1 Conceptualisation and Identification of the Problem

Two provisions under the Joint Contracts Tribunal's 1980 edition of standard form of building contract referred to in the United Kingdom as the JCT80 may give rise to money claims by the contractor. They are clause 26, which deals with loss and/or expense caused by matters materially affecting the regular progress of works (§§ 4.4.0) and clause 34.3 dealing with loss and expense as a consequence of findings of antiquities and objects of value on site during excavation. The prototype models the process of evaluating claims under clause 26, which are the most common and important in practice.

The clause largely deals with the contractor's and nominated sub-contractor's rights to financial reimbursement for events which are breaches of contract by, or which are within the control of the employer himself, others for whom he is responsible, or the architect acting on the employer's behalf. Once the claim for loss and/or expense has been made in a written application by the contractor, the architect and/or quantity surveyor must ascertain the validity of the claim and certify it.

The clause lists relevant matters for which the employer is under obligation to compensate the contractor if he can establish that he has incurred or was likely to incur direct loss and/or expense not otherwise reimbursable under the contract.

In acquiring the knowledge for the system design, the conditions of contract (JCT80) was supplemented by case law and related literature [2, 3, 136] in which the implications of concepts such as "reasonable time" and "ascertainment" as well as the evidence required to substantiate these claims are extensively dealt with. Based on the review of the literature (Chapter Three and Four) and consultations during the case studies (Chapter Seven) the whole process of justifying direct loss and/or expense claims was reduced to logic deductions as illustrated in simple terms by the flowchart in Figure 11.11.

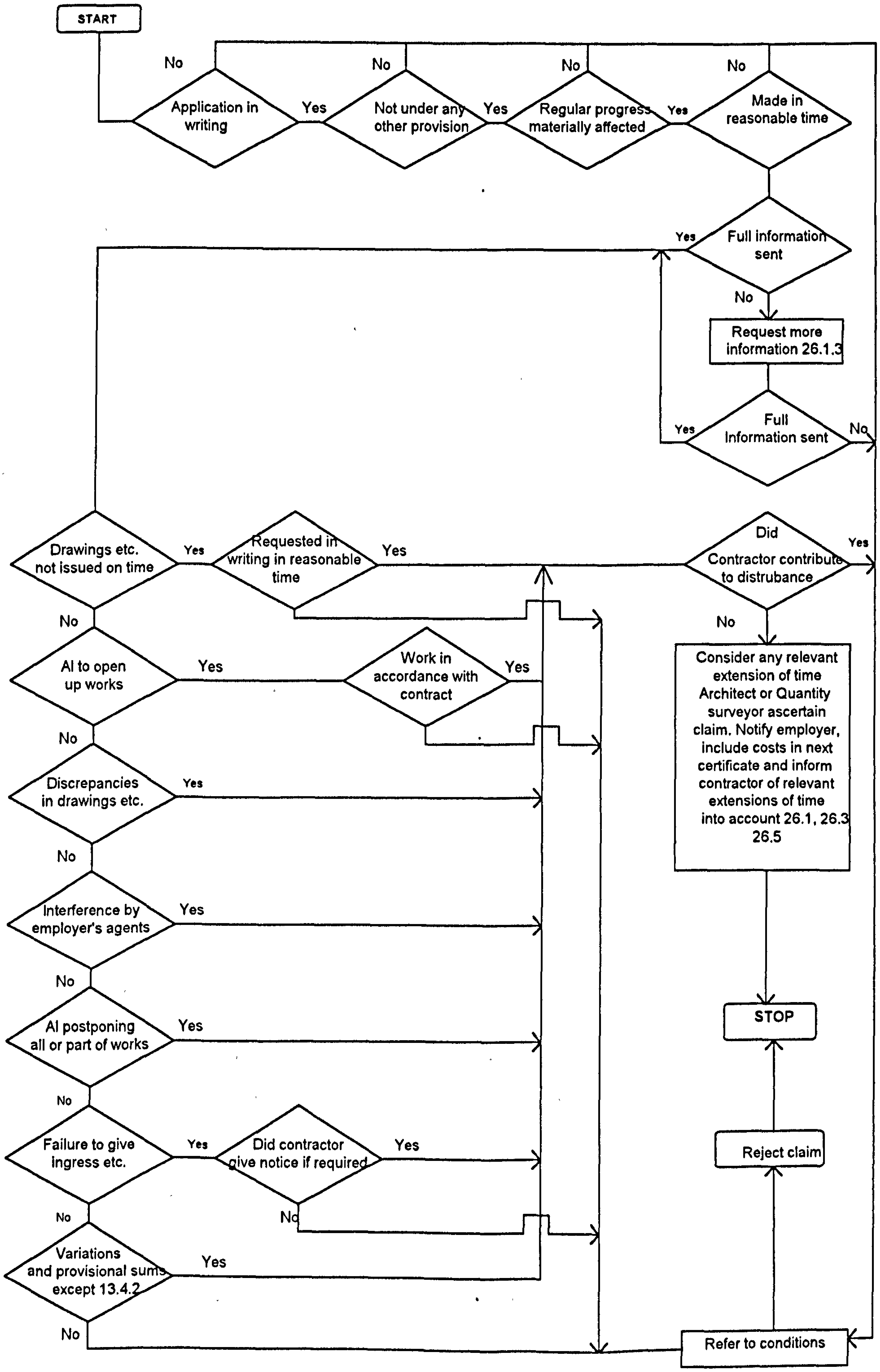


Figure 11.11: Flowchart for analysing loss and/or expense claims

11.5.1.1 Formalisation of acquired knowledge

The task of evaluating claims for loss and expense under the terms of Clause 26 after a careful study lent itself easily to a formalisation using predicate logic. Also because of the experience of other researchers on law related systems and the limitations of software and hardware available at the university a simple rule based system was used.

The formalisation of the domain knowledge thus involved combining the experience of experts, factual data required by the provision of contract, case law in the area of money claims for prolongation and disruption of works in knowledge acquisition process. This enabled a rule-based system to be implemented. A series of IF<condition>THEN<action> logic arranged in a manner that reflects the reasoning of an expert was derived. The top rule set representing the relevant matters that form the basis of loss and/or expense claim by a contractor is illustrated by figure 11.12.

IF Deferment of possesion

OR Lack of instructuions or information

OR Opening up of covered works and inspection

OR Action of independent artists engaged engaged by the employer

OR Lack of ingress or to the site

OR Employers failure to supply materials as agreed

OR Variation of the works

THEN The direct loss and/or expense claim is valid

Figure 11.12: Top level rules for relevant matters

Each of the OR alternatives represents events whose impact on the regular progress of works entitles the contractor to compensation. An event of this type is hereafter referred to as a relevant matter. Each relevant matter represented in the top rule set is subject certain conditions which must be satisfied before the architect or quantity surveyor ascertains the claim. The contractor is however required to make a written application in a reasonable time. He must ensure that the claim was reimbursable only under this clause and that he did not in any way contribute to the disruption of the works. Incorporating these conditions to each relevant matter is illustrated in Figure 11.14 for the instance of deferment of possession of site.

IF	Deferment of possesion of site
AND	Contractor makes wrtten application
AND	The application is made in reasonable time
AND	Claim is reimburseable only under clause 26
AND	The contractor did not contribute to the disruption of the works
THEN	The direct loss and/or expense claim is valid

Figure 11.14: Adding conditions to each relevant matter

11.5.2 Implementation Environment

In order to keep initial development costs to a minimum Crystal [199] available at the University was chosen to take advantage of the experience of its use. CRYSTAL as knowledge engineering environment proved adequate for this prototype because it has built in interface facilities to access Lotus 1-2-3 spreadsheet compatible files, DBaseIII and Foxprow files and generally allows DOS applications to be run. This was especially useful since it is envisaged that applications to perform critical path analysis (CPM) or other project management software, essential in establishing delays in completing projects will be required in a fully operational system.

The inclusion of these interfaces was crucial to the utility of the system as some of these applications notably Lotus 1-2-3 and dBase III compatible systems are widely used for aspects of claims evaluation: quantification and documentation.

11.5.3 The Working System

Consultation with the system begins with the user being provided with a menu of options listing all the relevant matters, followed by the user providing responses to questions in form of YES, NO. The system locates applicable rules, asks further questions peculiar to each relevant matter to establish its validity. For example, if the relevant matter is one of failure by the employer to give ingress to or egress from the site, then, questions as to whether the employer has given an express undertaking to do so or whether this access is under his control or whether the contractor has notified the architect to that effect are asked by the system. This listing of the system is shown in Appendix 10.

At every stage in the consultation, the user can call for explanations which are in the form of summaries of cases, conditions of contract and general notes. After the validity of the relevant matter is established, the system the helps the user to access cost files held in spreadsheets or relational database, retrieves costs data and evaluates the cost of labour, materials, and preliminaries and output the result in a format suitable for presentation.

11.5.3.1 System Facilities

Given that the context of any claim can change with events on site, it was necessary to incorporate a consultation saving facility. This gave the user the option to have a printout of the consultation or save on the hard disk. Another feature is the provision of the option for the user to input the relevant cost data required to estimate the value of the claim where such project data is not in a format that can be accessed by the system or is not available in the system hard disk.

Lastly, using a template of the claim presentation format proposed in chapter 12 the user is given the option to have a printout of the claim document suitable for presentation or save the file in ASCII format for further word-processing as appropriate. Where such documentation is not required a summary of the merits of the claim is provided for user reference in the form of: (i) details of contract provided during consultation; (ii) a summary of questions and the answers the user gave and (iii) conclusions and recommendation made by the system.

11.5.4 Results of preliminary tests

The outcome of preliminary test of the prototype are presented under the headings of (i) the logic of the system and conclusions; (ii) documentation the system provides; (iii) the utility of the interfaces and (iv) the explanation of help facilities.

11.5.4.1 System logic and conclusions

Preliminary tests of the prototype by the domain expert suggests that it adequately represent the logic that an expert would adopt in evaluating loss and expense claims. However, the level of abstraction of the system remained high. This requires further investigation of some of the legal concepts involved in the analysis of the claims. The system conclusions were found in most cases to be one an expert would draw given the same factual situations.

11.5.4 .2 Documentation

The documentation provided by the system in the form of appropriately generated correspondence, calculated claims was found to be basic and required further refinement to be of maximum use in a practical system.

11.5.4 .3 Utility of interfaces

The interfaces provided to access spreadsheet and database files to update or extract cost and other data for determination of quantum of claims was adequate for the initial prototype.

11.5.4 .4 Explanation and help facilities

These facilities were found to severely limited by the chosen development environment. It is proposed to incorporate a hypertext system with database of case law, authoritative quotes and explanations to aid the system user.

11.6.0 Outstanding system development work

The main outstanding systems development necessary for implementing the system outlined by this research is that of further software development mainly to build the interface to link the component sub-systems and the testing and evaluation of the resultant system in industry. Due to the limitations of the Crystal environment especially in interfacing other applications the whole system may have to be re-coded in a universal programming environment such as Visual Basic for Windows.

11.7.0 Summary

This chapter has defined the structure, processes, components and modules of an integrated computer-based system based on the case studies of real claims situations (§§7.0). The conceptual model based on the initial systems analysis and design has been introduced and its implementation implication discussed. Also, the methodology adopted to implement the expert systems sub-system for evaluating claims for loss and/or expense under clause 26 of JCT standard form(private with quantities), was described. Based on the systems analysis the functional requirements of an integrated computer-based system were defined. An outline of the prototype based on this concept was given, the development process described and the result of internal preliminary tests of the prototype presented.

CHAPTER TWELVE

A FRAMEWORK FOR BETTER CLAIMS MANAGEMENT

12.1.0 Introduction

In Part A of this thesis the main issues involved in the management of claims in practice were examined along with the possible role of information technology (Part B). In this chapter a number of proposals aimed at improving claims management in the construction industry are advanced and explained. The background to these proposals which represent the highlights of the research so far are first briefly described.

12.2.0 Background

The survey of contractors and consultants revealed that many practical problems hinder effective claims management. The subsequent case studies and interviews also threw light on the management issues identified by the survey. The main findings of this investigation so far which relate directly to the evolution of this framework of proposals are as follows:

1. ONE OF THE MAIN REASONS FOR THE REJECTION OF ALL OR PART OF CONTRACTORS CLAIMS BY CONSULTANTS IS INADEQUATE INFORMATION ON THE CLAIM BEING MADE.

To remedy this finding it is proposed to: (i) improve site activity documentation; (ii) develop a matrix of documents capable of capturing information required in claims preparation and evaluation; (iii) develop specific procedures for keeping project records and (iv) adopt information capturing techniques afforded by electronic document management systems technology. This will then make it feasible to utilise computer-based systems more efficiently for claims management.

2. OF ALL THE ASPECTS OF CLAIMS PREPARATION, THE IDENTIFICATION OF CLAIMS RELEVANT INFORMATION, THEIR RETRIEVAL AND CLAIMS DOCUMENT PREPARATION INVOLVE MOST TIME AND COST TO THE CONTRACTOR.

The consequence of this problem is that, most contractors avoid site document retrieval as an initial tactic by adopting the global claim technique which most consultants and owners find unacceptable. Case studies revealed that this is done by using cost accounting records or reports designed for budgetary control of projects. This reason is that first, the way in which site activity information is recorded makes identification and retrieval difficult. Secondly, the current methods of storing and retrieving records are not cost effective and third, assembling the claims document is a laborious task for which more efficient tools are needed.

3. THE INABILITY OF CONTRACTOR TO PRESENT CLAIMS WITHIN REASONABLE TIME IS A CONSEQUENCE OF A LACK OF RESOURCES.

The implication is that first, claims management is not considered a priority in most contracting organisations and second the skills required to undertake claims evaluation and preparation are not always available. There is therefore a case for training to improve this situation because it was evident in the case studies that the preparation and evaluation of claims need to be improved in order to reduce the number of disputes. Additionally, it may be necessary to assign this function to specially trained project team member or engage specialist consultants where circumstances dictate that particular claims-related knowledge and skills are required.

4. MOST CONTRACTORS ARE INCLINED TO USE THEIR OWN STAFF TO PREPARE CLAIMS RATHER THAN USE EXTERNAL CONSULTANTS.

It follows that, to manage claims better the contractor must recognise this function and set up the necessary management processes and resources to deal adequately with claims.

5. THE USE OF FORMULAE TO QUANTIFY CLAIMS IS A MAJOR REASON FOR DISAGREEMENTS OVER QUANTUM

In this circumstance the only possible approach to claim quantification to avoid disputes especially where the use of formulae(particularly estimation of head office overheads, interest and finance charges, disruption and loss of profit)cannot be justified is to rely on audited site and cost records retained as part of a dispute avoidance strategy.

6 THE QUANTUM OF ON-SITE OVERHEADS IS LIKELY TO BE DISPUTED BECAUSE OF THE NON-AVAILABILITY OF CONTRACTOR'S BUILD-UP OF PRELIMINARIES AND LACK OF PLANT AND LABOUR RECORDS.

This research so far suggests that although it is the practice for contractors to quote a percentage of the cost of works to cover preliminaries in tendering this approach to the evaluation of on-site overheads very often led to disputes. To avoid such disputes, it may be necessary for contractors to disclose their build-up of preliminaries in claims situations or alternatively, employers should consider the submission of the build-up as a condition for accepting tenders.

The main conclusion that can be drawn from the case studies of actual claim situations and interviews is summarised by the following statement.

7 THE CONTRACTOR'S PROGRAMME IS OFTEN POORLY PREPARED AND ARE NOT UPDATED AFTER CONSTRUCTION STARTS. FURTHERMORE, ON COMPLEX PROJECTS SIMPLISTIC BAR CHARTS ARE USED.

The review of the literature on the role of programmes in this respect suggests that where a programme is properly prepared and updated, the likelihood of disputes is reduced [114]. This finding shows that the type of programme, the information it should contain and the procedures for updating them needs to be adequately specified during procurement to enforce their use. This can be achieved first, by adequate contractual provisions and second by proper drafting of specifications of the type and scope of programmes to be prepared and used.

8. A GREAT OF RELIANCE IS PLACED ON THE COST REPORTS FROM THE ACCOUNTS DEPARTMENT DESIGNED FOR BUDGETARY CONTROL TO DETERMINE RESOURCE ALLOCATION.

This implies that, if the content and clarity of the site reports from site agents can be ensured through an internal Quality Assurance system then the contractors' Quantity Surveyors would be encouraged to rely on these reports for claims management purposes.

The summary of the research of the management problems briefly explained above confirm that in order to improve claims management, the following matters have to be addressed. These are: (i) improvement in project activity documentation; (ii) the preparation and specification of schedules; (iii) specification of methods of claims documentation; (iv) adopting technologies capable of reducing the effort required in (i), (ii) and (iii); (v) changing current project management culture and (vi) assigning the function to specially trained staff.

Several concepts are introduced in addressing these issues. These are defined in Appendix 7. The specific recommendations for achieving better claims management in these areas are stated in the following section.

12.3.0 Main Proposals

***Proposal 1*: A matrix of documents or their near equivalents that record resource use, performance and events on site with specific reference to scheduled project activities should be implemented.**

The use of document formats described later should be standard practice on projects with serious claims possibilities.

***Proposal 2*: It should be a requirement on every construction project to prepare and maintain a resource loaded network schedule based on the CPM technique to aid the determination of the cost and time impact of site events on specific project activities.**

***Proposal 3*: It is desirable that the requirements for claims submittals be specified at project inception to ensure an adequate standard of claims documentation.**

Proposal 4: The requirement in (2) should be enforced by incorporating in contracts a standard specification for programming of works with every standard form. Such a specification should also detail the minimum requirements for keeping contemporary site activity records.

Proposal 5: To overcome the problem of document assembly, retrieval and data access in claims preparation electronic document management systems should be implemented.

Proposal 6: Ideological training which includes the use of Information Technology for information management and claim preparation methods using project records and programmes is needed.

Proposal 7: On medium to large projects the claims management function should be assigned one member of the project team specifically trained for this task.

12.4.0 _Proposal 1_:A matrix of documents or their near equivalents that record resource use, performance and events on site with specific reference to scheduled project activities should be implemented.

The case studies and interviews (Chapter Seven) showed a wide array of different document formats for similar purposes in different organisations. Examination of these documents revealed the following main shortcomings:

- failure to capture all essential data;
- duplication of data across several forms;
- the data on virtually all forms needed to be keyed manually into a computer system whenever they were needed. The huge expense and delays of this process discouraged input except in the rare cases where circumstances dictated such expenditures;

- forms had been designed for traditional claims processing for person and calculator. Particularly relationship between data, e.g. time sheet and labour costs records had to be identified and maintained by the human.

To get over these shortcomings the forms were redesigned to take account of practices recommended in literature and by interviews. Data normalisation was a key part of the design process (Chapter Eleven). Normalisation is a process used in computer systems design to transform data into natural groupings such that one fact or data is in one place and the correct relationships between facts exist [236, 237].This process used by relational database systems designers to implement new and improved records[1] for organisations to construct database systems was applied to all site records obtained in the case studies.

The redesigned format proposed for adoption as standard practice cover the following documents: (i) progress reports; (ii) daily and weekly records or reports; (iii) job diary; (iv) test reports and records; (v) variation records; (vi) shop drawings and (vi) records of errors and/or omissions (vii) site photographs and; (viii) minutes of site meeting. Included in this process was the information which literature suggest a claim submittal should provide (**§§12.4.3**). The technology now exists to process these forms in a manner which allows the data to be scanned into computer systems, thus obviating the

[1]The process removes duplication of data on forms, groups and links data to make manipulation and retrieval easier.

need for manual input. How the technology can be used to access data on these documents are therefore explained.

12.4.1 Progress Reports

The contractor should record progress using appropriate documentation and retain copies. Such progress records should be updated periodically (preferably daily or weekly). During update, information such as actual starts, actual completion and percentage completion for all activities in progress should be recorded. Figure 12.1 is proposed for recording and updating progress on each activity. It may be worth noting that no such record was found during the case studies.

The aim of such a record is that where disruptive or delaying event occurs, the information so recorded can be directly incorporated in the programme of works using automatic data capture or manual entry into a common database to evaluate the impact on the overall completion of works using network schedules.

12.4.2 Daily and Weekly Reports

Two of the most important site records are the labour and plant time sheets. Due the deficiencies in the format obtained (§§**12.11.0**) the format in Figure 12.2 is proposed.

The time sheets should be signed and reviewed for completeness and accuracy by the Contractor's Agents and filed. This improved format will make it possible for the contractor to identify periods when operatives and plant are engaged on a particular project activity. As a result, it becomes feasible to compare actual resource allocated to a particular activity to the planned allocation. Using this time sheet will reduce the difficulty experienced by contractors in costing disruption and delays.

A similar format that can be applied to plant is illustrated in Figure 12.3 which is much simpler format compared to that used by the contractor shown in Figure 12.14.

Activity Ref. No.	Description	Planned Start date	Actual Start date	Actual Finnish date	% Completion	Comment
Date: Day:			Updating Officer: Signature:			

Figure 12.1 : Activity update form

Contract No.						Date:
Day:			ACTUAL HOURS WORKED			
Clock No.	Act. Ref. No.	Trade	Start	Finish	Total	Comment

Completed by: . . . . Approved by: . . . .

Position: . . . . Position: . . . .

Figure 12.2: Proposed time sheet with direct link to scheduled activity

Contract No.						Date:
Day:			ACTUAL HOURS WORKED			
Plant.	Act. Ref. No.	Number	Start	Finish	Total	Comment

Completed		Approved	
by:	....	by:	....
Position:	....	Position:	....

Figure 12.3: Proposed Plant sheet with direct link to schedule activity

The data on both forms can be captured automatically into a relational database using a combination of optical character, intelligent character and optical mark recognition technology (§§**12.11.0**). The captured data can then be accessed by functional application packages such as valuation and planning to evaluate to cost and time impact of events on project activities.

12.4.3 Photographs/Video Recordings

Photographs and videotaped recording which takes account of the visual progress of works and site conditions should be maintained on fairly complex projects. These should be taken periodically(weekly) of the salient features of the project, to record each phase of construction. Such photographs should then be filed chronologically, documenting the date, time of the day and angle of shot.

Where an electronic document management system is implemented these visual records can be indexed and archived using document image processing application (§§**12.11.2**) using affordable laser storage media (§§**12.11.3**).

12.4.4 The Job Diary

The resident works administrator (Project Manager) and his superintendents should maintain a daily job dairy that summarises the days events. Such notes should include pertinent comments or decisions made in response to such comments or suggestions made by parties involved with the project. A tick sheet may be used to record information as an *aide memoir*.

All disputes or disagreements with contracting parties should be fully detailed. Of particular importance are differences relating to methods, scope of work, variations, stop-work orders, defects or discrepancies in drawings, specifications and payments. In cases involving major disputes, a separate memorandum should be prepared to preserve all possible evidence with detailed information on events that are likely to lead to a claim.

The job diary should be a bound book, retained as a permanent record upon job completion. Contemporaneous entry into a coded database (§§**12.4.5**) is encouraged because it can facilitate later claims substantiation. Using available document image processing technology (§§**12.4.5.3**) the pages of the job diary can be scanned to create an electronic library. Access to particular information in this library can be improved be bar-coding each page for indexing information under specific headings. For example, using bar-codes it possible to identify days on which inclement weather was experienced.

12.4.5 Test reports and records

The testing of all materials and contractor-furnished equipment should be maintained. These will naturally include records of items tested, the specification for testing, the time of day item was tested, date of testing, parties conducting the test, witnesses and any failures and re-tests undertaken. Where independent material testing laboratories are used, it must be ensured that, it is certified to conduct the desired test. The records of all the results of the tests should be maintained in a separate file. These records can be treated similarly as plant and time sheets (§§**12.4.1.2**) for the purposes of data capture and document management.

12.4.6 Record of Variations

The tabular format shown in Figure 4 is recommended for recording the details of every variation. The importance of such a record in context of claims and disputes is discussed in section **12.11**. It includes the following information: the variation order number, contract reference number, the scope of varied work, date of initiation and project activity affected; estimated cost; the time impact; reference documents; start and finish dates of varied work and comments.

Contract No.:	Architect/Engineer:
Variation No.:	Activity Ref. No.

Scope of changed work:

Activity Affected:____________________ Schedule Ref.:______________________

Amount of variation order:£__________________

Date of notice to proceed:______________

Time extension granted(Wks):___________

Date varied work started:______________

Date varied work completed:___________

Impact(underline or enter an option)

1. Increased crew size
2. Slow down
3. Removal of crew
4.

Reference documents:

Ref. No.	Description

Prepared by:	Date:

Figure 12.4: Variation status report

The data recorded on this form can be automatically entered into the project database directly using computers (§§**12.6.2**) to assess the impact of variations. Imaging technology (§§**12.6.3**) may then to used to archive this record to substantiate later claims.

12.4.6.1 Scope of Changed Work/Activity

This part of the form should describe briefly the nature of the work which has been varied, stating the location and operations involved.

12.4.6.2 Reference to Programme

The section should provide details of activity affected by the variation order with respect to the date of notice to proceed, date the work started, date of completion, estimated time extension granted and value of the variation.

12.4.6.3 Impact of Variation Order

The should specify the impact of the variation order on the project activity in question. The impact of the order which can include effects such as increased crew size, slow down, plant removal and acceleration, stoppages should be noted.

12.4.6.4 Reference Documents

Variation orders are normally related to changes to work processes, materials or design changes. Where a variation is made the appropriate revised drawings and specifications should be recorded along with any communications on the variation order.

It will be good practice for the contractor to make a copy of this report available to the contract administrator soon after the variation order is made.

12.4.7 Record of Drawings

A transaction register of drawing submittals should be maintained and must include the following information: the scheduled submission dates; actual submittal dates; and the receiving officer (Figure 12.5). The existence of such register can influence the way disputes are settled (§§**12.11.0**).

Drawing No.	Description	Date Due	Date Received	Signature (Receiving Officer)	Comment

Figure 12.5: Format for drawings register (Adapted from Lock, D.(1995). *Project Management*, 5th Edition, Gower Publications England.)

This data recorded and entered in project database contemporaneously with archived and indexed drawings using DIP (§§**12.6.0**) can be used to track and demonstrate the cost and time impact of design changes on the progress of work.

12.4.8 Records of Errors and Omissions

All errors, discrepancies or omissions and any requests for clarification encountered during the life of the project should be recorded in an organised manner. Such records will generate a database that can demonstrate changes to resource output on particular project activities.

Requests for information as well as errors and/or omissions can be recorded using the format in Figure 12.6. This should prove adequate for the extraction of claim relevant information on discrepancies and divergence between contact documents (§§**12.11.0**).

Contract No.	Sheet No.:
Error & Omission No.:	
Nature of error and omission:	
Activity Reference:	
Date of Notification:	Specification section reference:
Impact on Activity(select or add options	1. Stopped all work
	2. Lost hours
	3. Removal of crew
	4.
	5.
	Prepared by: Signature: Date:

Figure 12.6: Errors and Omission Analysis

14.4.9 Minutes of Site Meetings

There appears to be no established procedure for recording and distributing records of site meetings. The minutes studied had sufficient detail for claims management purposes. However, as a way of ensuring that their content can confirm the occurrence of events on site the following project management procedures are proposed.

1. Copies of minutes of all site meetings and objections and exceptions taken by any of the parties involved should be retained. These should be filed chronologically or

by activity reference (identical to those used in the project schedules). These minutes must provide a complete and accurate record of the agenda and a summary of all substantial discussions. Progress problems or issues raised should be documented and any actions to be taken, as well by whom should be noted.

2. The minutes should record those attending and absent from the meeting. Copies should be sent to all parties involved or needing to know about the meeting or particular issues discussed. Any party taking exceptions or objections to any aspect of the content of the minutes should do so in writing within a specified period after receiving a copy.

12.5.0 *Proposal 2*: It should be a requirement on every construction project to prepare and maintain a resource loaded network schedule based on the CPM technique to aid the determination of the cost and time impact of site events on specific project activities.

The best way to measure the length of a delay and its effect on the uncompleted work is by a network schedule. Bar charts are less effective than network schedules (see **§§12.11.0**). In order to use network programming tools to manage claims, a minimum criteria for their preparation needs to specified during procurement. This should include the following [114, 120]:

- establishing feasibility of the schedule before construction starts;
- specify the type of diagram to be used;
- specifying the minimum number of activities the programme should have;
- specifying approval requirements;
- a clear statement of updating procedures;
- detailing requirements for cost loading;
- when major revisions and time extensions can be done;
- requiring general contractor to involve sub-contractors in developing the programme;
- requiring all physical access and availability restraints to be included into the schedule;
- specifying an explicit period for review and approval of shop drawings, instructions and other information are to be submitted;
- requiring owner furnished equipment to be incorporated into a contractor's schedule;
- specifying sanctions for non-compliance of initial schedule submitted and subsequent update of the programme;
- procedures for float use and reporting.

These criteria are satisfied by the model specification proposed by Wickwire *et al* [120]. The recommended specification for programming in Appendix 4 is based on the this model. The reasons and implications of this proposal is discussed in section **12.11.0.**

12.6.0 Proposal 3: It is desirable that the requirements for claims submittals be specified at project inception to ensure an adequate standard of claims documentation.

For clarity, it is recommended that a minimum level of claim documentation be established early in the project's life. Such a requirement should it is proposed, include the following:

- the preferred format of claims;
- the preferred method of substantiating each type of claim;
- what documents constitute detailed information for each type of claim;
- the preferred method of quantification for each head of claim.

The object of this proposal, as with those in sections **12.3** and **12.4**, is avoid the use of global claims methods as far as possible.

12.6.1 The Recommended Format of Claims Submissions

The main guidelines for documenting claims are as follows:

1. Delays affecting the date of completion should be evaluated using the CPM technique, adjusted to show contractor-caused delays. The activities delayed, should be clearly marked on the summary delay chart with the appropriate activity references used in the original and updated CPM schedule.

2. The quantification of delays and disruption should relate to specific activities on the project schedule whether on the critical path or not. This will permit the direct extraction of data from the proposed site reports.

3. Head office overheads, profit and interest should be calculated using actual audited cost records copies of which should be attached as an appendix (Appendix 8).

The claim document in all cases should be in a format which includes the following sections (information):

Project Title

This should give the full title and location of the project as well as the reference number for the claim.

Event Narrative

A brief description of the event(s) which have led to the additional cost and time being claimed. There should be a reference to the relevant contractual clause under which the event falls and the schedule activity affected.

Project Activity Information

This should describe the scheduled project activity, with its reference number, the planned start and completion dates and the actual start and completion dates of the activity.

Effect of Event on Project Activity

The effect of the alleged event should be indicated. For example, whether the scheduled activity has been delayed, disrupted or both should be stated with any time extension that has been granted.

Estimated Loss and/or expense

This section should indicate the estimated cost of the event on the activity under the headings: on-site overheads, head office overheads, cost of disruption, interest and finance charges and profit.

Appendices

The appendices should include a schedule of preliminaries, plant and labour cost summaries, records of communications on the event, summary of delays, the as-built and as-planned schedule and a detailed calculation of each head of claim.

Where the claim is for delays, it is proposed that the delay cost breakdown format shown in Figure 12.7 should accompany the claim summary. For disruption claims the disruption analysis format (Figure 12.8) is proposed. The site records from which the information is extracted should be those proposed for site activity documentation in §§**12.4.0** or their near equivalents. Copies of the records should form part of the claim documentation. The electronic copies can be speedily retrieved where an electronic document management system is in place. All other supporting documentation should accompany the claims document.

Delay Cost Sheet No.:

Breakdown Claim No.:

Activity:

Category of Labour	No.	Rate/man-day	Delay duration	Amount
Plant:		Rate/week or day		
Site Overheads:		Rate /week		Amount

Figure 12.7: Delay Cost Breakdown Format

As far as possible the rates quoted in the site overheads sections of Figure 12.7 should be should be justified. A schedule of preliminaries should accompany the cost breakdown to explain the rate and cost items under site overheads.

Disruption Cost Analysis Sheet No.:

Claim No. Activity ref. no.:

Activity:

PLANT

Type	Planned Output	Average Output B/F Disruption	Actual Output	Loss of Output(%)	Unit cost	Amount
					Total Cost	
LABOUR						
Trades						
					Total Cost	

Figure 12.8: Disruption Cost Analysis Format

The basis of this claim documentation format is to enable direct data retrieval from the records proposed in §§**12.4.** (Figure 12.1). The column headed "average output B/F Disruption" represent the average output for labour and plant prior to the occurrence of the alleged disrupting event. Planned output can be derived directly from the original resource allocation from networked activity schedule. By applying actual percentage completion (Figure 12.10) to the planned output per trade and averaging the result for each day over a period before the occurrence of the event. The difference between the average output before the event and actual output will yield an estimate of the loss of output. With unit costs extracted from the schedule the cost of the loss of output can be estimated. The schema in Figure 12.9 illustrates the process of generating the claim documentation.

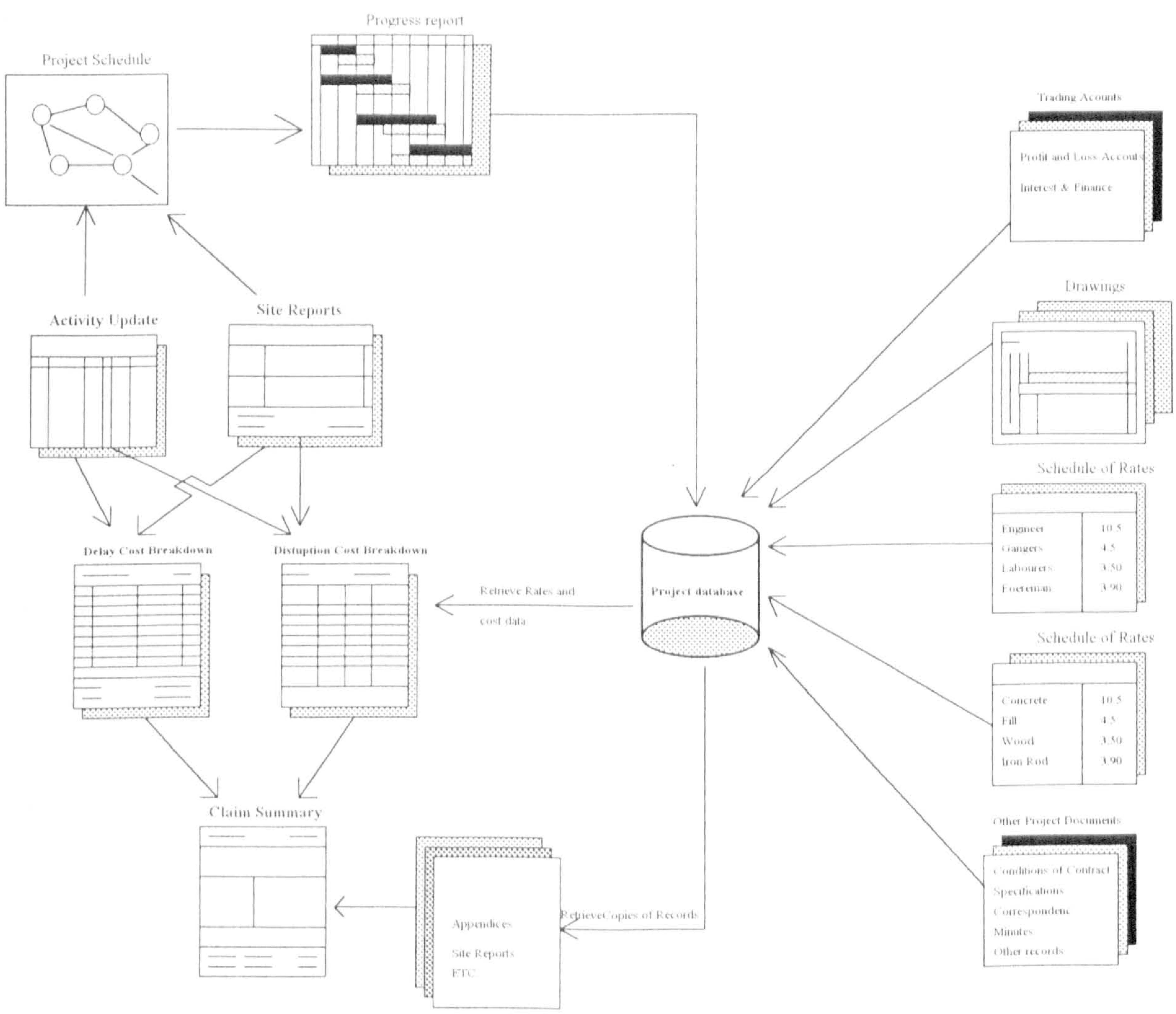


Figure 12.9: Claim documentation using project documents

By using this format the summaries of cost impact of any delays and disruptions can be generated directly from the project activity records described earlier using a simple relational database application. This matrix of records combined with the use of Information Technology tools reduces the task of extracting of cost data on each project activity. In so doing, the need or tendency to rely on cost accounting reports becomes the least attractive method of claims preparation.

12.6.2 Claims Presentation

For clarity on the scope and extent of the value of claims, the following require particular attention in preparing the claim documentation:

- preparing the overall time and cost impact report;
- preparing summary of as-planned, as-built and as-adjusted schedules;
- special graphics to illustrate extent of cost and time impact.

12.6.2.1 Overall time and cost impact report

The suggested approach is to use claim summary information in §§**12.6.1** to prepare an overall time and cost impact. Figure 12.10 will be suitable method of tabulation. The result of this process for a number of smaller claims essentially synthesises all the relevant job records generated by the project activity documentation. It summarises the analysis of the project schedule, the major delays and problems encountered during the project, assigns responsibility and states delay damages with reference to each project activity. Illustrating clearly, the effect of each event on the time and cost of project activities affected.

Claim No.	Activity Ref. No.	Event	Total Delay	Concurrent Delay	Delay Claimed	Amount(£)	Comment
		TOTALS					

Figure 12.10: Overall cost and time impact tabulation

A similar tabulation can deal with disruption by replacing the columns for total delay with percentage disruption as shown in Figure 12.11.

Claim No.	Activity Ref. No.	Event	% Disruption	Amount(£)	Comment
		TOTALS			

Figure 12.11: Disruption impact assessment by activity

This cost impact review can then be illustrated graphically using a simple bar chart backed by a print out of the as-built and as-planned schedule of works as part of the requirements for keeping a detailed project schedule.

12.6.3 As-planned, As-built and As-adjusted schedules

These should adequately summarise the detailed planned schedules and actual performance to support the analysis of delays and disruptions. They should be accompanied by the overall cost and time impact tabulation or charts that identify all major activities or phases of work, key project milestones and major interfaces. Their main effect, is to highlight all major delays and/or disruptions encountered during project execution.

12.6.4 Special graphics

To illustrate the changed scope of works it is beneficial to use charts representing the details of major and controlling events on an individual basis. A plotted chart for example, analysing variation orders using the variation status report, requests for information (RFI) and responses can include the following: (i) a manpower chart showing a comparison of planned versus actual resources expended. This will help to show the causal link between the event and actual man-hours; (ii) compare the scheduled and actual delivery dates of equipment and materials; (iii) prepare an S-curve that demonstrates the effect of the events encountered and operating results.

These presentations can be done using scheduling and spreadsheet packages to good effect with minimum manpower. This is attainable where site records, preparation and maintenance of programmes of work are kept diligently. The proposals outlined in previous sections are designed to make this possible on all projects.

12.7.0 ***Proposal 4*****: The requirement in proposal 2 should be enforced by incorporating in contracts a standard specification for programming of works with every standard form. Such a specification should also detail the minimum requirements for keeping contemporary site activity records.**

Amendments to provisions relating to the settlement of claims resulting from the owner or contract administrator's actions should be considered. This is essential for enforcing and encouraging the practices proposed in proposals 1 and 2. The findings of this research suggests that the construction contract can be used to ensure adequate site documentation, monitoring of performance and speedy claims settlement. Unfortunately, most of the standard forms of contract used in the UK are deficient in this respect (see §§**12.11.0**). Additional provisions or amendments to conditions of contract should be considered to implement aspects of these proposals namely:

- specification of the minimum level of records of resource deployment on site;
- incorporation of programming specifications to include details such as: (i) resource allocation on each activity; (ii) a schedule of drawings and instructions should be in place at project inception; (iii) adequate sanctions for non-compliance with the requirement of (i) and (ii); (iv) explicit procedure for updating programmes and associated schedules;
- a requirement (optional) to set-out claim in a specific format.

The legal implications of requirement to prepare and maintain programmes which will make the greatest impact on how projects are managed are discussed in §§**12.11.0**.

12.8.0 *Proposal 5*: To overcome the problem of document assembly, retrieval and data access in claims preparation electronic document management system should be implemented.

It is recommended that electronic document management systems (EDMS) be implemented to enable access to the whole range of documents and data associated with each project activity. Manual access to such data is possible with the recommended site records structure (§§12 3.1) into a relational database on small projects. However, on medium to large projects automatic data entry is recommended for economy on site management cost. EDMS technology associated with Document Image Processing can enable access to whole documents electronically to make document assembly for claim substantiation and data retrieval cost effective.

12.8.1 Manual Data entry

Relational database records can be designed to capture the same information (from the records in §§12.3.0) from the computer keyboard. For example, the activity update form can be computerised using a database interface with seven record fields corresponding to those in Figure 12.1. The data on the variation status report if similarly entered into the database, will make it possible to relate performance on a particular activity to the variation impact. This can be done similarly for all the documents proposed in this guideline. The result is that, the time and effort required to collate factual data to quantify claims and assemble documentation is reduced. For example, data on activities in progress can be accessed by a scheduling package to generate progress charts if stored in a suitable database file format. Figure 12.12 illustrates the basics of manual entry for subsequent activity data extraction from record fields.

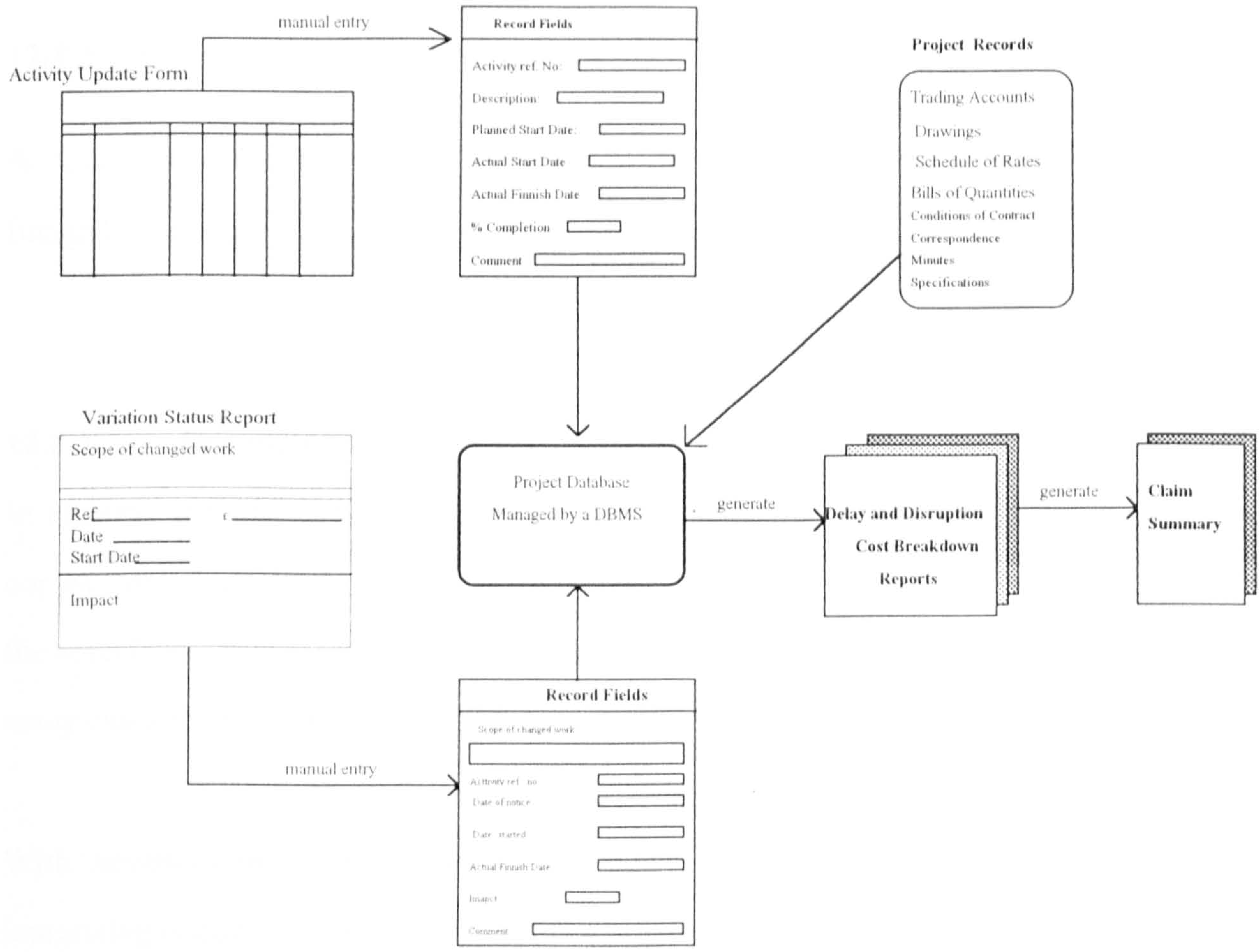


Figure 12.12: Manual entry of site data into a project database

12.8.2 Automatic data entry

The entry of the information recorded in the forms suggested into an integrated project database automatically from the traditional paper forms is now largely possible as result of developments in scanning technology particularly in the areas of : (1) bar coding for the tracking of physical documents; (2) Optical Character Recognition (OCR); (3) Intelligent Character Recognition (ICR); (4) Optical Mark Recognition (OMR) and; documents. The explanation of how this technology can be applied to claims management is presented in section **10.3.1**. These technologies associated with EDMS collectively removed the need for manual entry of data from key boards.

12.8.3 Access to whole documents

Access to whole documents as opposed to data can be achieved using Document Image Processing (DIP) and cheap storage mediums.

12.8.3.1 Document Image Processing(DIP)

In essence, it is the use of computers to store and retrieve images which represents copies of documents. The computer system therefore, replaces the paper filestore(filing cabinet) or micro graphic systems (microfilm and microfiche) and in many cases the paper documents can be disposed of completely.

With advances in computer network technology, such a system is capable of integrating documents from all the sources of information required for the preparation and evaluation of claims. For example, the Quantity Surveyor(QS) can retrieve copies site records and correspondence relating to particular events. With such access the contractors' QS will be able to prepare a detailed claim documentation based on these records for settlement soon after the occurrence of the event. The basics of the technology is described in §§10.3.

12.8.3.2 Cost Effective Electronic Storage

Laser disks offer huge storage capacity with lower cost per megabyte but were intrinsically a better medium than magnetic disks. Referred to as *COLD* this storage media should be implemented with the Imaging (§§10.3.1) and data extraction modules (§§10.3.1). The various alternative storage mediums available are described in chapter ten(§§10.3.2) while the main benefits of implementing this technology is discussed in section 12.11.5.

12.9.0 *Proposal 6*: Ideological training which includes the use of Information Technology for information management and claim preparation methods using project records and programmes is needed.

In order to gain the benefits of the recommendations set forth in this section, training is necessary [238] . This should be done at two levels, operational (site) and strategic (head office). Such a programme of training must provide a general understanding of the requirements for better claims management and the acquisition of the technical skills required to use the proposed computer technology to facilitate cost effective claims management.

12.9.1 Ideological training for claims management

This should be directed at management. The main components of this training are: (i) the goals and benefits of successful claims management. Why the need to change current practices and how the proposed framework improves decision making and dispute management capability; (ii) organisational implications for the project management team; (iii) addressing fundamental implications such changes in the roles and activities of each team member and how they are controlled in the new set up. This is particularly important where claim management function is assigned to one project team member proposed in §§**12.10**.

12.9.2. Operational training

These should be undertaken to familiarise the appropriate personnel with the operational aspects of the new management set up necessitated by the implementation of these proposals. Gangers and Foremen have to understand and record the appropriate data on the site report sheets upon which improved claims management depends.

Quantity Surveyors, Project managers and Engineers have to be familiar with the requirements for claim preparation and evaluation to supervise their subordinates. Issues relating to quantification and the need to prepare promptly claims using site records should be stressed. Specifically training in the following respects is necessary:

- how to use detailed schedules and recorded data to evaluate the effect of events on the completion of the project and cost its financial impact;
- recording and using site activity documentation to monitor the progress of works;
- using database management systems, electronic document management systems and scheduling packages to facilitate claims preparation

Operational staff such gangers and foremen would need to undertake ideological training to motivate them to accept the new practices with greater emphasis on the practical requirements to achieve the goal of the proposed framework. This is necessary in order to encourage the recording of the required data and the acquisition of the skills needed to assist in the capturing of such data into Databases or Electronic Document Management Systems as the case may be.

12.10 *Proposal 7*: On medium to large projects the claims management function should be assigned one member of the project team specifically trained for this task.

Contractors normally assign the claims management function to the Quantity Surveyor in addition to his traditional functions in the project management team. However, due to the demands of their traditional roles, the preparation and submission of fully detailed claims is often deferred until practical completion. This was the situation in all the cases studied. To ensure that this practice does not continue, it is desirable to train a number of personnel and assign them this duty. Such officers can handle more than one project and also assist in ensuring effective monitoring and documentation of the project.

The main advantage for this arrangement is that such officers will be well versed in the day to day management of the project and thus better placed to evaluate the implication of events on site.

12.11.0 Justification of Proposals

12.11.1 Site Activity Documentation

This research has established that site records kept by contractors often lack the detail required to relate sums claimed to particular project activities and/or events. This, in part, is the result of the fact that most of the site reporting requirements were designed for internal cost accounting purposes. To make the contents of the site records capable of recording an acceptable level of details that will permit easy retrieval of claims-relevant information which can stand scrutiny by an independent assessor, three objectives must be satisfied.

These are: (i) to identify the type, quality and distribution of records to be kept on all projects; (ii) facilitate the use of a disciplined standard of documentation of site activity and proof of the consequence of site events; and (iii) encourage parties (especially contractors) to preserve records daily on every element of the project administration and performance to enable a third party to reconstruct the project from these records if necessary.

The project records considered in this regard are: (i) minutes of site meetings; (ii) progress charts and reports; (iii) daily and weekly records or reports; (iv) site photographs; (v) job diary; (vi)test reports and records; (vii) variation records; (viii) shop drawings and (ix) records of errors and/or omissions.

The formats of the matrix of documents proposed here provide the basis for a much more principled preparation and evaluation of any contractors' claims. It also represents an effective way of influencing the speed with which information is recorded and responded to. Above all, it is envisaged that implementing these proposals would result in the reduction in the tendency to use the global approach or general formulae in claims quantification except in extreme cases.

All the main site and project records kept by contractors were examined during the case studies to identify their main deficiencies. In this vein, alternative formats are proposed in some cases not only to permit easy assembly of cost data on each project activity for claims quantification but also to allow automatic data capture using information technology tools. Where, the documentation is adequate suggestions for making them more accessible are proposed.

12.11.1.1 Progress Charts and Reports

Progress charts and reports can afford all parties to contract the opportunity to evaluate performance on each project activity and therefore the project as a whole. The presence of these reports are therefore, a valuable source of data for updating the programme of works where necessary and the initiating of remedial action. The case studies and interview showed clearly that most contractors do not have a structured methods for recording progress. This is confirmed in the industry survey in which 40.8% of contractors cited lack of contemporary records of resources for delays in preparing claims (Chapter Six).

12.11.1.2 Time Sheets

An example of a typical format of contractors site report obtained from the case studies, is the time sheet shown in Figure 12.13. This document is deficient in one important respect. The format, at best is only ideal for weekly payroll accounting. In the event of a claim for delay and/or disruption to a specific project activity, it is not possible to determine the actual deployment of labour and other resources such as plant if this format is used.

Contract No.___			Project:								Date:
			T= Transfer S=Sickness H=Holidays A= Absent								
			ACTUAL DAILY HOURS WORKED								
Clock No.	Name	Trade	M	T	W	T	F	S	S	Total Hours	
Completed by:____________				Approved by:____________							
Position:____________				Position:____________							

Figure 12.13: Typical format of a labour time sheet

In the light of this flaw, this report sheet has been re-designed to record actual resource deployment by project activity. The suggested format for time sheets is shown in Figure 12.2 is the result of the normalisation[2].

12.11.1.3. Variations of works

Variation of works is one of the main reasons for delays and disruption claims [242]. In the case studies undertaken is was notable that, detailed information on the nature of variation orders were not maintained. This is yet another contributory factor in the tendency to quantify the extent of delay or disruption to the progress of works using general formulae which the survey showed, was very likely to lead to disputes.

To ensure clarity in later claims documentation, all variations ordered by the Contract Administrator should be recorded with reference to the scheduled activity (ties) in question. Maintaining such detail would enable a claimant to satisfy the provisions of standard forms of contract. For example, clause 26.1.2 of the JCT80 requires every application for loss and/or expense resulting from a variation be supported by information or details necessary for the Architect to ascertain the claim. This record should therefore include: the changed performance status of the activity in question; time and cost estimates; and the effect of the variation on the cost and time of the project.

12.11.1.4 Drawings

Another major reason for disruption to work is the piecemeal release of design information to contractors. Despite this problem, it is not yet standard practice to prepare a schedule of design drawings required for the benefit of all parties concerned.

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[2]This is a database design technique for reducing duplication of data

Case law suggests that, it is good practice for the Contractor to prepare a schedule of further drawings which is then made available to the contract administrator at the beginning of the project [119]. Such a schedule may constitute evidence of failure to supply information which in turn is a ground for claims for loss and/or expense or time extensions delays and disruptions. The schedule should list the dates such further drawings and/or information are due, in tandem with the agreed programme of works. This can be extracted from certain CPM packages by indicating information requirements as a resource. This is crucial if the reasonableness of the schedule of drawings is not to be questioned.

12.11.1.5 Errors and Omissions

It is a requirement of most standard forms that any errors and omissions found in contract documents should rectified by the contract administrator. Provisions such as the clauses 2.2 and 2.3 of the JCT80 stipulates that, the contractor should give a written notice to the Architect specifying any discrepancies, divergencies and errors found in the bills of contract. ICE (6th) in clause 55.2 sets out the terms for any errors and omission to corrected by the engineer with special emphasis on quantities and rates quoted in the Bills of Quantities or schedule of rates respectively which may affect the prices and quantities significantly.

Documenting any errors and omission is necessary as recent research [12] suggests that, many claims made by contractors relate to the poor quality of drawings and/or specifications. The nature of these errors or omissions in documentation should be recorded to give an indication of the scope of any delays or disruptions resulting from them. Also, this information can then be used to support future claims.

Requests for information as well as errors and/or omissions can be recorded. The format suggested in Figure 12.9 should prove adequate for the extraction of claim relevant information on discrepancies and divergence between contact documents.

12.11.2 Preparation and specification of schedules

According to Sweet [25], a CPM network schedule has at least three advantages the most significant of them is that, from a litigation standpoint, requiring the contractor to maintain a CPM schedule helps prove or disprove the impact of employer-caused delays.

A properly prepared and legal binding requirement to prepare and maintain programmes of works (schedules) is therefore, a valuable tool for assessing the changes in the scope of a project with respect to time and cost [110]. The programme, in this respect, can serve as benchmark for assessing the difference between planned resource and actual resource deployed in a manner that is acceptable for both contract administrators and contractor in dispute situations [114].

Unfortunately, the case studies and interviews with a number of practitioners found that in practice, schedules are often poorly prepared, in many instances in the form of simplistic bar charts which are not very useful in claims and dispute situations.

The neglect of this valuable management tool prevents the delivery of an on-time, on-budget and most importantly dispute free completion of works. The relationship between dispute on projects and inappropriate scheduling methods is confirmed by the survey [112], of employers in which 73% of the respondents who sometimes or usually experienced delays and additional cost believed that poor scheduling was very or somewhat significant in causing the additional expenditure.

As a consequence, the courts in the US for example, have consistently held that bar charts are less effective that network diagrams in defining delays. In the case of *Haas and Haynie Corp.*[239] for instance, the US General Services Board of Contract refused to accept a bar chart to prove a delay because the bar chart could not depict the effect of changes on the interrelationship of job activities as a CPM schedule could. However, because of the visibility of bar charts, they may be used to demonstrate the process or result of critical path analysis.

Network schedules are therefore necessary for showing the interrelationship among causes of project delay. This means that, where the employer and the contractor contribute to a delayed completion, neither can recover monetary damages unless the delay can be apportioned between them. If both parties contribute to a delay i.e. the delays are concurrent and neither is able to apportion responsibility, neither party can claim additional costs or liquidated damages from the other. Bar charts cannot show this interrelationship and hence have not been accepted at least in North American courts as a clear proof of the apportionment of delay in contrast to network schedules [240]. Using the network scheduling technique is therefore an essential requirement for managing claims and dispute resolution [4, 120]).

These criteria (§§12.6.0) are satisfied by the model specification proposed by Wickwire *et al* [120] which has been adapted for use as part of these guidelines (Appendix 4).

12.11.3.0 Claims documentation

Assembling claim documentation has been identified as one of the most time consuming aspects of claims preparation. Lack of resources apart, because none of the standard forms of contract specify what format claim documentation should take the quality of the document in terms of detail depends on the preference, experience and training of the contractor's Quantity Surveyor.

12.11.3.1 Problems with current practice

The format currently used by most contractors in presenting claims in terms of structure is such that it is manifestly difficult to relate damages being claimed to the event.

Typically, the claim documentation will have the following sections: project narrative, narrative of events with reference to the relevant contractual clauses, claim summary, detailed calculation of each head of claim accompanied in some cases by programme analysis. The claim documentation however, varies from the verbose to the terse. In every instance, these were lacking in terms of showing a nexus between damages being claimed and the alleged delaying or disrupting event.

12.11.4. Enhanced Contractual Provisions

Although the Latham Report [23] makes some recommendations with respect to the exchange of design information it is silent on the question of ensuring project documentation as part of a concerted attempt to speed up dispute resolution. Amendments to provisions relating to the resolution of cost escalation resulting from the owner or contract administrator's actions should be considered. However, implementing these proposals have legal implications especially with respect to the requirement to prepare and maintain programmes and the submission of bidding documents. The main duties affected by the recommended provisions are now briefly discussed.

12.11.4.1 Implications Incorporating Specifications to Prepare Programme of Works

The incorporation of contractors programme into contract as proposed here will result in further obligations and warranties being imposed on all parties. Four main obligations may be implied. These are:

- a duty to co-ordinate and schedule the works
- a duty not to hinder, interfere or delay with the works
- a duty to co-operate
- a duty to grant the contractor a reasonable time extension

Duty to co-ordinate and schedule works

The incorporation of programmes, will impose on the contractor an obligation to schedule and execute the work of all trades on the project in a reasonable sequence of activities. The schedule cannot therefore be prepared in a manner that favours the contractors own performance and interferes with the performance of sub-contractors.

Failure to co-ordinate and schedule the work of sub-contractors may be fatal to the main contractor in claims situations. With the implied obligation not to hinder the progress of sub-contractors, the contractor can be held responsible for sub-contractors' delay costs.

Duty not to delay, hinder or interfere

It will become an implied obligation of the contract that all parties warrant that they will not hinder, delay or interfere with the performance of other parties to the contract. A breach of this duty will mean the party concerned have to bear the cost of any delays or disruptions to other parties performance.

Duty to co-operate

This duty is similar to the duty not to hinder, delay or interfere with another party's work. Both duties address what is perceived in contract law as fundamental relationship for performance of the contract. This duty can be breached by a broad range of acts and omissions. For example, failure to issue instruction and drawings according to the schedules requirement.

Duty to grant reasonable time extension

Construction contracts out of necessity include provisions requiring the contract administrator to grant time extensions if specified delays occur. With an appropriate liquidated damages mechanism, an express provision to produce and update the programme, can be construed that the employer's agent (Contract administrator) must grant time extensions in timely manner. This because, with these provisions, time extensions have to be granted in a reasonable time to enable the contractor to incorporate the additional time into his progress schedule and be able to co-ordinate the remainder of the work. In this situation time extensions granted after practical completion will therefore be of no use to the contractor.

Also when the employer demands that the contractor perform within the original or adjusted programme, even though the contractor is entitled, it may be that the contractor has to accelerate his progress i.e. a claim for acceleration would be valid. Similarly, where the contract administrator fails to grant adequate time extensions in a timely manner, it may amount to an acceleration order.

However, this is particularly important with the use of network schedules because unless the time extension is granted soon after the occurrence of the event, the CPM cannot be revised to reflect the actual situation. The consequence will be schedules covering periods of delays and/or disruption(for which the contractor may be entitled to a time extension) would show that the contractor is behind schedule while in fact they may well be ahead on the critical path.

Failure to grant the necessary time extension will therefore distort the CPM schedule leaving the employer open to acceleration claims. In addition, if the employer waits until practical completion before granting time extension he cannot rely on the CPM schedule to deny recovery since the schedule will not reflect changes in performance.

The celebrated American case of *Fortec Constructors v. United States*([241] illustrates the consequences of breaching this duty. In this case, Fortec claimed time extension and additional expenditure resulting from several design modifications issued by the Army Corps of Engineer (Corps). The Corps relying on the CPM schedule denied the claim. The court however held that, they were not entitled schedule since they has failed ensure that it reflected actual performance. Failure of parties to address time extensions in timely and diligent manner will therefore indicate that scheduling disputes and litigation may arise.

12.11.4.2 Submission of build-up of preliminaries

It is not uncommon in claims negotiations to find that the proof of a contractor's claim lies in the build-up of preliminaries and other bidding documents [13]. The problem with this situation is that employers often reject or doubt the findings of the examination of build-ups based on the idea that, for example, years has elapsed since a bid was made. The contractor has therefore had ample opportunity to alter the documents in his favour. It is therefore logical to implement a system whereby the build-up and other documents are deposited with a neutral party. The implication is that in any subsequent adjudication of disputed claims any documents not included in this submission will not be admissible [243] Such a provision will circumvent protracted negotiation which are often aimed at establishing the cost of planned resource allocation in order to estimate claims for additional expenditure.

12.11.5. 0 Using computers for record keeping and claim documentation

12.11.5.1 Automatic data entry

The entry of the information recorded in the forms suggested into an integrated project database automatically from the traditional paper forms is now largely possible as result of developments in scanning technology particularly in the areas of : (i) bar coding for the tracking of physical documents; (ii) Optical Character Recognition (OCR); (iii) Intelligent Character Recognition (ICR); (iv) Optical Mark Recognition (OMR) and; documents. The explanation of how this technology can be applied to claims management is presented in Chapter Ten. These technologies associated with EDMS collectively removed the need for manual entry of data fro key boards.

12.11.5.2 Access to whole documents

Access to whole documents as opposed to data can be achieved using Document Image Processing(DIP)(§§**10.3.1**) and cheap storage mediums commonly referred to a *COLD* (§§**10.3.2**). The key component of DIP is the input system which includes a scanner together with an associated software. The growing range of scanning systems offer speeds and capabilities to meet all requirements.

12.11.5.3 Benefits of adopting EDMS technology

Adopting this technology referred to collectively as electronic document management systems removes the need for manual entry and remove the reduce the difficulty currently experienced in identifying, retrieving and assembling claims relevant information. As a recent research [222] showed, throughout a year, 40% of a persons time is spent searching for information that already exists. There is some evidence that, the application of this technology eliminates the need for filing, sorting and purging, it improves file security and removes the problem of lost files leading to the reduction of operating cost.

It is proposed that, that the application of EDMS technology in conjunction with the suggested site activity documentation will enable the claims management process to take advantage of a number of benefits. These include [223]: faster task completion, improvement of quality, cost reduction, reduced storage space and shortened time scale of processes. In the context of claims preparation and evaluation this would mean (§§ **10.6.0**): (i) a speedy preparation of claims documentation; (ii) reduced cost of claims preparation; (iii) enable efficient access all claims relevant information; and (iv) access to information across functions and applications.

12.11.6 Data integrity

Where computers are used to maintain these records back-up copies should be maintained and if necessary hard copies made to ensure there is no loss of information in the event of computer disk failure or other catastrophe. However, with the advent of Computer Output to Laser Disk Cold (COLD) which has accompanied EDMS, it now possible to back up files without keeping the paper copy at less cost.

12.11.7 Options for Financing the cost of Implementing IT solutions

Three different ways of financing the hardware and software requirement must be considered. These are outright purchase, rent or lease.

12.11.7.1 Purchasing

This usually offers most potential cost savings over a period. The main disadvantages with this option are the risk of obsolesce and lack of flexibility. The purchaser will normally take a maintenance agreement with the manufacturers. In the case of software this may be compulsory for the first year but may include new versions when available. Vendors will sometimes upgrade machines which have been bought or allow them as trade-ins for other models. The option however, ties up capital which might be more effectively used elsewhere.

12.11.7.2 Renting

Renting is often over a short period. The agreement can be cancelled by the user at short notice normally one or two months. It is the most expensive option but provides the greatest flexibility. However, as the contractor for example will have to invest in training, preparation and implementation it not that easy to withdraw from the agreement.

12.11.7.3 Leasing

This is compromise between purchasing and renting. It would normally cost less but requires an agreement for a set period of time - three to seven years. Maintenance and servicing are included in the cost with an option to purchase at the end of the lease period. Although lacking the flexibility of rentals the leasor can often upgrade to a larger system before the lease expires.

The leasing or purchasing option is probably suited for the implementation of systems at head office while rentals for site use can be considered depending on the size of the project and its duration.

12.12.0 Benefits and Costs of Implementing Recommendations

Although it is difficult to measure the main benefits of implementing these recommendations, it is envisaged that these would include: (i) better demonstration of entitlement to a claim; (ii) clear and understandable quantification of claims; (iii) improved quality of site records for documenting events; (iv) closer control of likely changes in project scope; (v) a documentation standard that provides a clear picture of the state of the project, such the output of resources, where they were deployed, on what project activity and how they were affected during the currency of the project; (vi) better evaluation of disruptive events and how they affect particular activities; (vii) improved 'team spirit', better relationship between contract administrator, general contractor, sub-contractor and employer; (viii) speedy resolution of claims without recourse to adversarial proceedings for settlement; (ix) reduce lack of information as a reason for protracted negotiation and settlement of claims.

The main cost of implementation would generally include the additional man-days required to a operate the system. On medium to large projects, equipment, training, vendor support to maintain the systems and potentially employee dissatisfaction will be the main cost of implementation. An additional cost which should be recognised is that the well organised contractor who appreciates the need to resource the claims management function as proposed might loose bids to the less organised. Consultants need to appreciate that in the long run, the added cost of a well organised contractor will be far less than the cost of protracted disputes. This factor should therefore be a serious consideration in the award of construction contracts.

12.13.0 Summary

The recommendations outlined in this document seek to combine best practice with innovative approach to the issues of claims management. By combining modern management techniques afforded by technology in the fashion recommended, claims on construction project will become more manageable. Also, implementation will reduce significantly the frustration associated with claims preparation and evaluation. The recommendations are also intended to provide a viable alternative to the current haphazard approach to the preparation and evaluation of claims. On the whole this alternative steers claimants away from the controversial global claims approach.

CHAPTER THIRTEEN

EVALUATION OF PROPOSALS

13.10 Introduction

In chapter twelve seven main specific proposals were made to improve claims management through a combination of changes to site activity documentation, contractual provisions and the application of information technology. These proposals were sent to 20 practitioners in the construction industry (contractors and consultants) to evaluate with respect to their feasibility as a means of achieving significant improvement in the management of claims. This chapter reports the results of the evaluation process.

13.2.0 Contractors Evaluation of Proposals

13.2.1 Proposal 1

This proposal recommended the use of a matrix of records designed to capture information on each scheduled project activity to aid information retrieval for claims preparation and evaluation.(§§**12.2.0**). Of the 10 contractors who responded, 8 indicated that they believed that if these proposed format of documents were kept the task of preparing claims and information retrieval would be significantly improved. The information content of the records were deemed adequate. A minority (1 out of 10) were not sure of their possible impact. The evaluation of each proposed record is shown in Table 13.1. Most of the practitioners indicated that the information content of the proposed records were adequate, useful but in some cases will require training to complete and additional manpower to maintain. They majority indicated that the

Document		Activity Update Form	Time Sheet	Plant sheet	Job Diary	Test Reports and Records	Variation Status report	Record of Drawings	Errors and Ommision Analysis
Ease of Completion	*Simple*	3	8	9	5	7	4	7	4
	Requires Trianing	7	2	1	5	3	6	3	6
Relevance	*Very Useful*	5	3	2	8	8	3	8	3
	Useful	5	7	8	2	2	7	2	7
	Not Useful	0	0	0	0	0	0	0	0
Manpower Requirment	*At Current Levels*	4	2	3	8	10	3	9	6
	Additional	6	8	7	2	0	7	1	4
	Marginal	0	0	0	0	0	0	0	0
Information Content	*Adequate*	9	8	9	8	10	8	10	8
	Inadequate	1	2	1	2	0	2	1	2

Table 13.1: Contractors' Evaluation of Proposal 1

proposed record for errors and omissions analysis and drawings were not useful in terms of their relevance and the information content was inadequate. The general impression of the contractors is that the concept of a matrix of documents, with recorded information on each scheduled project activity overcomes the problem of identification, retrieval supporting documents in claim preparation. This perception of the proposals is borne out by the comments of the Commercial Manager of Gourney (Appendix 11) that at the very least it ensures that "information relevant to claims and in fact project management will be there". Proposal 1 if implemented will result in a better management of claims.

13.2.2 Proposal 2

In response to the proposal to make it a requirement to prepare and maintain resource loaded network schedules based on CPM techniques, 9 out of 10 contractors indicated that although an effective tool it needs to understood to aid claims preparation and evaluation. All agreed that the resource requirements for maintaining such schedules would be high but necessary to achieve significant improvements in claims management. The majority indicated that the criteria for preparing the schedules set in the model specification was reasonable and practicable as a means of ensuring its use on all construction projects. There is agreement that the use of resource loaded network schedule within the terms similar to the model proposal (appendix 4) is a viable means of achieving better claims management.

13.2.3 Proposal 3

To the proposal for making it a requirement to submit claims in a specified format (§§12.3.0) most respondents indicated that the suggested format will not be easy to prepare while the information the contractor had to include was much too detailed.

However, their response to the formats for accompanying documents indicates that 8 out of 10 thought the delay cost breakdown was inadequate with respect to information content, will require training to prepare, additional manpower to maintain but were useful for the intended purpose. The responses suggest that specifying the format of claims will not necessary improve claims documentation. The contractor should be free to make submittals in whatever form he wishes but it should be accompanied by the appropriate delay cost breakdown and disruption cost analysis or their equivalents to detail the claim.

13.2.4 Proposal 4

This proposal was aimed at incorporating construction contracts standard specifications for the preparation and maintenance of network schedules set out in §§**12.3.0** and a minimum requirement for keeping site records. The indication of 8 out of 10 of the contractors was that its implementation would lead to better claims management. A majority (7 out of 10) believed that incorporating such terms would change their legal obligations under contracts but would encourage good practice. With respect to the proposal to include provisions to incorporate specifications for programmes of work, all respondents indicated that it would change their current legal obligations but would result in better claims management.

On the specifications requirements to grant time extensions, 7 out of 10 indicated that it would speed up claims settlement, ensure a higher level of certainty about project costs before practical completion but would not be difficult to implement.

For provisions requiring the contractor to keep and permit the employer to audit records, the contractors indicated that it would speed up claims settlement and ensure certainty on project cost but would be difficult to implement. Similar views were expressed with respect to the requirement to submit build-up of preliminaries and other bidding documents. With respect to claim submittals, the contractors indicated that it would neither speed up claims settlement to ensure certainty of projects costs and would be generally difficult to implement.

13.2.5 Proposal 5

In response to the proposal that electronic document management systems should be used to overcome problems with document assembly, retrieval and data access, 7 out of 10 indicated that EDMS will reduce the cost of information retrieval. 8 out of 10 indicated the cost of managing documents will reduce while leading to improvements in the contractors' ability to substantiate claims.

All respondents however indicated that it might be costly to implement on every project. 9 out of 10 indicated that they were certain about its advantages over current practices. At the same time 8 out of 10 indicated that the technology would need to be tried to gain acceptance.

It is concluded from this response and the case studies that: (i) the cost managing claims relevant documents, the cost of information retrieval can be reduced through the use of EDMS. The technology will improve the contractors' ability to substantiate claims; (ii) the EDMS technology has a definite advantage over their current document management practice but will need to be tried to gain a general use in the construction industry.

13.2.6 Proposal 6

On training, all respondents indicated that ideological training was needed to achieve significant improvements in claims management. All indicated that operational training was very important to implement successfully all the proposals.

The responses show that training of construction personnel needs to include the use of technology for information management and claims is necessary to achieve better claims management within the context to the framework.

13.2.7 Proposal 7

Of the 10 contractors, 7 indicated that assigning the claims management function on large and medium sized projects was necessary to improve claims management. All indicated that this can be implemented on project of medium to large size. It is therefore good practice on substantial construction works to assign the claims management function.

13.3.0 Consultants Evaluation

13.3.1 Proposal 1

All consultants indicated that the matrix of records for site activity documentation or their near equivalents proposed would improve claims preparation and information retrieval quite significantly. 3 out of 10 indicated that the resources required would have to increase above current levels. A majority (9 out of 10) indicate that the information content of the records were adequate for claims management purposes and would make the identification and retrieval of relevant information easier. The detailed responses of the respondents are summarised in Table 13.2.

Most consultants felt that the information content of the records were adequate and useful but the activity update form, variation status report, errors analysis and the job diary would require training to complete. The was therefore a general endorsement of the main proposal to record events, resource use and progress directly on each scheduled project activity to aid claims preparation and evaluation.

13.3.2 Proposal 2

The consultants (7 out of 10) indicated that the requirement to prepare and maintain resource loaded CPM schedules was an effective tool for improving claims management but needs to be properly understood to aid claims settlement. They 9 out of 10 agreed that the resource requirements can be readily absorbed within current resource outlay on projects. The proposed model was a reasonable and viable means of ensuring the use of schedules on construction projects.

13.3.3 Proposal 3

Of the respondents 6 out of the 10 consultants indicated that the proposed format for claims submittals would not be easy to prepare with respect to its clarity and also the format required to much detailed information.

The responses suggest that, all the information included in these documents were judged to be useful except that for delay cost breakdown. All the documents were deemed to have adequate information for claims settlement purposes.

Document		Activity Update Form	Time Sheet	Plant sheet	Job Diary	Test Reports and Records	Variation Status report	Record of Drawings	Errors and Ommision Analysis
Ease of Completion	*Simple*	3	8	9	5	7	4	7	4
	Requires Trianing	7	2	1	5	3	6	3	6
Relevance	*Very Useful*	5	3	2	8	8	3	8	3
	Useful	5	7	8	2	2	7	2	7
	Not Useful	0	0	0	0	0	0	0	0
Manpower Requirment	*At Current Levels*	4	2	3	8	10	3	9	6
	Additional	6	8	7	2	0	7	1	4
	Marginal	0	0	0	0	0	0	0	0
Information Content	*Adequate*	9	8	9	8	10	8	10	8
	Inadequate	1	2	1	2	0	2	1	2

Table 13.2: Consultants' Evaluation of Proposal 1

13.3.4 Proposal 4

6 Consultants indicated that the current contractual provisions were adequate for claims purposes but a requirement prepare to programmes of work using CPM schedules will not significantly change their legal obligations under contract.

Specifically, on provisions to incorporate programmes of work, 7 out of 10 judged it would lead to better claims management without changing significantly current legal obligations. 6 consultants indicated that the duty to grant time extensions in a specified time frame will not necessarily speed up claims settlement or result in a higher level of certainty about the eventual cost of projects. They would however be difficult to implement.

The same proportion of consultants indicated a similar view on the requirement for contractors to keep specified records, allow audits of records, using specified formats for claims and the submission of the build-up of costs and other bidding documents.

13.3.5 Proposal 5

On the possible impact of EDMS on claims management, 9 out of 10 judged that these systems will reduce the cost of data retrieval. Of the 10, 7 were certain it will reduce the cost of managing documents, 1 did not while 2 were not certain. 8 consultants indicated that the technology can improve contractors' ability to substantiate their claims.

With respect to resource requirements, 6 judged it would be costly on every project but the rest were not certain. The majority (8 out of 10) were not certain it had a definite advantage of current document management practice but all judged that the technology needs to be tried to gain acceptance in the industry. According to the consultants response, it can be concluded that using EDMS can result in cost savings in document management and information retrieval but the technology needs to be tried. This is in line with the opinion of contractors (§§**13.2.5**). This view appears to be motivated by the question who has to bear the cost of such systems. Clearly, a more detailed investigation is therefore necessary.

13.3.6 Proposal 6

All respondents indicated that ideological training was necessary to achieve improvements in claims management. Operational training was judged to be very important to successfully implement these proposals in full.

13.3.7 Proposal 7

On the assignment of the claims management function to a member of the project team specifically trained, all consultants indicated that this was a feasible and practicable way of achieving significant improvement on medium and large projects. The contractors also indicated that this will be a sound management strategy for claims (§§**13.2.7**)

13.4.0 Summary

From the evaluation of the proposals made in chapter twelve to improve claims management it can be suggested that:

1. The proposal to document events, resource use and progress of work with respect to scheduled project activity can significantly reduce the difficulty of identifying, retrieving, assembling and preparing claims. Their subsequent evaluation will be made easier and permit speedy settlement.

2. Standard specifications for preparing and maintaining resource loaded programmes of work needs accompany every construction contract as a means aiding claims management.

3. Providing a breakdown of costs of delays and disruptions with respect to each project activity to support claims will make claims evaluation and settlement easier.

4. Including provisions to incorporate programmes of work, can lead to better claims management without changing significantly current legal obligations of parties to construction contracts. There however remains some reservation as to the future legal implication for parties.

5. Training of construction personnel needs to include the use of technology for information management and claims is necessary to achieve better claims management within the context to the framework.

6. It is good practice on substantial construction works to assign the claims management function.

7. The cost managing claims relevant documents, the cost of information retrieval can be reduced through the use of EDMS. The technology will improve the contractors' ability to substantiate claims

8. The EDMS technology has a definite advantage over their current document management practice but will need to be tried to gain a general use in the construction industry.

9. Provisions requiring the contractor to keep and allow the employer to audit records and submit the build-up of preliminaries and other bidding documents will speed up claims settlement.

CHAPTER FOURTEEN

CONCLUSIONS AND RECOMMENDATIONS

14.1.0 Introduction

It is a commonly held view that, the contractor is required to submit well argued statements of his entitlements upon the occurrence of defined events recognised by construction contracts. These are generally referred to as "*claims*". The high incidence of disputes that arise as a result of such claims is well documented.

Attempts have been made to reduce this problem. Such attempts have in the main followed two main strands of research and expert commentary. The first, focuses on explaining the legal implication of common terms of contract. The other, attempts to ensure that there is equity in the allocation of risks under construction contracts. The latter suggests that, poor risk allocation determines the likely occurrence of claims and disputes. This has in recent years led to the development of new forms of contract and a clamour in some sections of industry for the redrafting of the main standard forms of building and civil engineering contracts.

Even though such attempts are useful, there has been very little or no reported investigation (at least in the public domain) to explain why claims and disputes continue to be on the increase. Some reported research indicates that, management was perhaps the most important factor responsible for this phenomenon. So far, written commentary on the management issues that claims imply and the solutions offered have been based on anecdotal evidence. The research reported in this thesis attempts to fill this gap in the construction industry's understanding of claims management.

This was achieved through extensive literature search, case law review, postal surveys, structured interviews and case studies. The aim was broadly, to identify the main shortcomings in claims management practice, their extent and causes, as a basis for proposing management changes that include the application of IT tools to improve current practice. This chapter presents the findings, conclusions and recommendations of the research. Recommendations for further research are also proposed.

14.2.0 Findings of the Research

The main findings of this research are as follows:

1. Of all the members of the contractors' project team, the Quantity Surveyor (QS) plays the most significant role in claims preparation. This is based on the understanding of the QS's hands on knowledge of the costing of works and cost monitoring of the relevant projects. Commercial Managers and Legal Advisors have greater involvement than Project Managers, Claims Surveyors or External Consultants.

2. On the Employers project team, the PQS who is directly responsible to the A/E, has a greater involvement than the Architect or Engineer. The Employer plays a secondary role in claims evaluation to ensure the independence of the A/E. However, this tradition is being departed from in situations where: (i) the client insists that claims be

submitted and evaluated to the letter of the contract; (ii) A/E's are now being sued successfully to recover costs of claims awarded to contractors.

3. In terms of demand on time the eight aspects of the claims preparation process: (i) Identifying relevant information; (ii) identifying sources of information; (iii) retrieving relevant information; (iv) archiving information; (v) interpretation of contracts and justifying claims; (vi) responding to A/E requests for information; (vii) quantifying claims and: (viii) claim document preparation were rated as follows (most demanding first):. (i) preparation of claims documents, (ii) identifying relevant information, (iii) claims quantification, (iv) claim justification and retrieval of information in that order. Archiving project information takes the least time. This suggests that, archiving is not accorded the importance it deserves because casual archiving is likely to result in insufficiently accessible records long after project staff have dispersed. More than two-thirds of respondents rated the time involved in the five highest ranked aspects of claims preparation between 6 and 10 on a 0 - 10 scale.

4. In terms of cost, the contractors indicated that preparing the claim document, quantifying the claim, retrieving information and identifying claims relevant information, in that order, are the most costly aspect of claims preparation. Also, interviews with their QS's suggested not only a lack of skill to prepare claims, but also that, gathering relevant information for quantification is costly. To avoid the additional cost of retrieving claims relevant information, many contractors use general formulae, or the so called "*global claim*" approach, which has been castigated repeatedly by the UK courts.

5 The reasons most likely to be commonly cited by consultants (A/E) for rejecting contractors' claims are non-entitlement in principle and inadequate information. They

ranked lack of breakdown of claims by causes above non-compliance with contractual procedures.

Non-entitlement in principle appears to be the most common ground for rejection of claims, contrary to expectation. This contradicts expert opinion that, justification of claims in principle is hardly ever a difficulty. This finding suggests that, the understanding of the terms of standard forms is still inadequate in spite of the large volume of information dedicated to interpreting them. Secondly, there appears to be a high incidence of contractors submitting unmeritorious claims on the off chance that a satisfactory outcome may just turn up. There is evidence from research in artificial intelligence and law that expert systems can help improve parties' ability to interpret terms of contract.

6. It was a common comment among consultants that, what little information is submitted to support claims is usually captured by systems designed to produce internal accounting information which has, at best, only the most tenuous connection with claims. Investigation of the underlying causes of this problem identified: (i) a culture of bias against paperwork on the part of site operatives; (ii) poor design of recording systems; (iii) the paper-based nature of most of the relevant information; (iv) poor resourcing of the claims management role in contracting organisations. This view was confirmed by the findings of the case studies. Some contractors openly admitted that even where the information is available, it is usually very expensive to retrieve and organise in the format required to support claims.

7 The global claim problem is inherently more difficult for contractors to overcome than the other grounds upon which claims are rejected. However, in terms of frequency in practice, it has been ranked only fourth and with a score below 5. This suggests that,

the extent of the problem may have been exaggerated by the high profile nature of the relevant court cases. Consultants interviewed indicated that, where reasonable efforts at particularisation are made, they have due regard to the realities of complexities of cause and effect on construction projects. However, every interviewee said they had come across the worst examples of the global claim approach, particularly in connection with costs of disruption.

8. Claims for cost of disruption and loss of productivity are the most problematic of all the common heads of claim. The methods available for quantifying this head assume that, the contractor has maintained adequate records of performance on the disrupted activities not only during the period of the disruption, but also in normal times. Most UK standard forms contain provisions which empower the contract administrator to require the contractor to keep records pertaining to situations likely to give rise to this head of claim. However, most of them are silent on the type and detail of programming required, the detail, format and general quality of records, and sanctions against failure to comply. The main difficulty in the UK stems mainly from the fact that the requirements for such programmes are not enforceable contractually. This research suggests that as a result, a valuable tool for settling disputes is lost and consequently, there is recourse to the global claims approach to which most consultants object.

Consultants lament the frequent lack of records and general poor quality of what is available, particularly programmes, most of which were only in Gantt chart form and were hardly ever a true reflection of actual site performance. It was also a general complaint that, in the absence of adequate records, contractors resort to claiming percentages of total labour estimates or actual labour costs of disrupted operations as the reimbursable element for disruption. The main drawback of this approach is that there is usually no objective justification for the percentage used.

9. The principle that a contractor should be reimbursed for under-recovery of head office overheads on account of prolongation caused by events for which the owner is responsible is hardly disputed. What is usually in dispute is its quantum. A number of methods, of which the *Hudson*, *Emden* and *Eichleay* formulae are the most popular, are used in quantifying this element of claims. The acceptability of the formulae have been touched upon by litigation, albeit with varying degrees of directness.

   The current position is that, their use would be acceptable provided the contractor is able to demonstrate that the assumptions underlying their use are satisfied. The above comments also apply broadly to recovery of profit. This research suggests that, by and large, many practitioners accept the use of these formulae. These heads of claim are challenged mostly on grounds of lack of the proof of the assumptions underlying entitlement to recovery and the lack of justification of the overhead percentages claimed.

10. Claims for interest and finance charges are accepted in principle. The indication is that, where a contractor presents the full trading accounts for the project the quoted interest could be claimed. In the absence of such evidence, the current rate of borrowing is used as a guide in negotiating a percentage for interest and finance charges

11. Opinion is still divided on whether the cost of preparing of a claim, either in-house or through independent claims consultants is reimbursable. This has been a matter of considerable controversy. According to one school of thought, where the terms of a contract expressly provide for the submission of claims, then the contractor would be deemed to have priced for the cost of preparing claims and should therefore not be entitled to recover this head. Most of the consultants interviewed subscribed to this view and invariably disallowed this head. Contractors are of the view that, where special investigation is carried out in order to quantify the claim and the scope of such research could not reasonably have been foreseen at the time of tendering, then the cost of preparing the claim ought to be allowed. The contractors' position is that, in the current state of the construction industry, the amount of effort required would in most cases satisfy this condition. Consultants, whilst expressing the view that they were bound to comply with the principle on non-recoverability, nevertheless recognised that, in the current climate of competition in construction, making allowances for costs of this scale in a tender would almost certainly result in loss of bids.

These views notwithstanding, many contractors continue to claim this head of cost even though they are aware of the argument against recoverability. Case law suggests that, they have chances of winning if they persist with the claim. The reason is that, if the claim ends up in litigation and the contractor chooses to formulate the claim as damages for breach of contract and not damages under the terms of the contract, the costs would be allowed under the principles governing the recovery of damages of breach of contract. This is because, even an express exclusion of such costs is futile because of legislation against unfair terms in contracts.

12. The research suggest that for claims for inflation of cost, the principle is not a very important issue. Rather it is the contractors' ability to present evidence of additional costs beyond that allowed by the price fluctuation clause in the contract which leads to disputes.

13. On-site overheads are usually disputed because of lack of transparency in contractors' quantification of this head of claim or the use of current unit costs of relevant resources which are often higher than the costs used by the contractor in tendering for the job. The problem of lack of transparency is most acute where the contractor priced preliminary items as a percentage of direct costs. Although current standard methods of measurement do not follow this approach, there was evidence that it is still being used. Contractors who adopt this pricing approach at tender, often quantify this head of claim as the same percentage of increases in the relevant work and with no attempt to relate the amount claimed to specific resources.

14. A lot has been made of the need to keep adequate records to substantiate claims. What actually happens in practice, according some observers, is the exact opposite. In order to substantiate these assertions contractors were asked to indicate, from their experience, the documents they are likely to use in their claim submissions. Consultants were also asked to indicate, their perceptions of the frequency with which contractors fail to submit specific documents required for the evaluation of claims. Their responses indicate that the documents most lacking are photographs, timesheets, and site diaries.

    As these are the most basic of site records, this finding is a sad reflection on the quality of site management. Interviews with contractors confirmed that, even where these records have been kept, access to the specific records required to support a particular claim is so expensive that it is not attempted unless arbitration or litigation is contemplated.

15. The technology required to reduce the expense of access to information from paper-sources is now well established. Electronic document management systems are now routinely used by insurers and the banks. They allow information stored in different forms and documents to be linked and accessed flexibly by subject matter with minimal transaction costs. This research suggests that, few contractors are even beginning to appreciate the values of these systems.

16. Computers are being used in the management of claims. However, the systems being used have been developed for other purposes and therefore place limitations on the way in which they can support claims management. Although claims are made in the currency of most projects there are no comprehensive systems designed to support every aspect of claims management.

17. The review of systems already used widely in the construction industry suggests that, on their own, these systems do not offer cost effective tools for supporting claims management. The way forward would be to incorporate these systems (expert systems, project management software and databases with electronic document management systems) on an integrated platform to achieve synergy.

14.3.0 Conclusions

The following conclusions can be made on the bases of these findings:

1. Claims preparation is not as yet regarded as a specialised project management function requiring the assignment of specific personnel in contracting organisations. Although such personnel may in fact exist, most contractors are reluctant to use such a job title for fear of being branded as "*claims conscious*". Also, internal preparation of claims is favoured over the use of external claims consultants. This means that, having well trained personnel capable of undertaking this function is important if well argued claims are to be produced.

2. Three main reasons can explain the clear indication that preparing claims takes a lot of time. Firstly, the construction industry is notorious for not documenting procedures and transactions. The consequence is that most of the information recorded is of a cost accounting nature. The problem with this type of records is that, they do not contain information relating directly to resource usage on scheduled project activities but only indicate apparent fluctuations in the cost of the project. The second is that, information on project activities are not readily accessible to individuals assigned these roles. Lastly, in an environment where most project information is transferred using the paper medium, the identification and subsequent retrieval of relevant information will be time consuming. Whichever situation applies, there is clear need for systematic documentation of project activities.

3. The research suggests that owners, by accepting some poorly substantiated claims, have failed to provide contractors with a real incentive to improve the quality of their information systems. Some contractors openly admitted that even where the information is available, it is usually very expensive to retrieve and organise in the format required to support claims.

4. The problem of lack of transparency is easily cured by the use of schedule of preliminaries not only for pricing tenders but also for quantifying on-site elements of claims. Where the schedule is in the form of a bar chart with annotations for costs per week or other appropriate planning periods, the impact of claim event on on-site overheads is only too apparent. The effectiveness of the schedule is limited only by the lack powers granted by standard forms of contract to contract administrators to require contractors to submit this type of information.

5. There is generally a prevalence poor resourcing of the claims management function which does not permit maintenance of the records of the requisite quality. Thus, the tendency to ignore claims until after completion, by which time human resources can be freed from other functions to investigate the claim. This practice seen by many critics as an indication of poor management.

6. The construction industry is not yet fully aware of the advantage of developments in computing in areas such as object-oriented programming, standards for application programming interfaces and document standards. Also, the emergence of electronic document management systems, is yet to exploited. There is therefore a need for a total appraisal by constructors organisation of their requirements for managing claims as a precursor to the implementation of systems dedicated to claims management. The conceptual model proposed in this

thesis which was partially validated by peers suggests that, it is basis for developing an integrated computer-based system to support claims management.

To alleviate these problems and improve current practice, it was proposed that : (i) a matrix of documents or their near equivalents that record resource use, performance and site events with reference to scheduled project activities be implemented; (ii) there should be a requirement to prepare and maintain resource-loaded CPM network schedules to aid the ascertainment of the cost and time impact of site events on specific activities. Standard specifications for these programmes and the minimum requirements for keeping site records should also be incorporated with all standard forms of building and civil engineering contracts; (iii) to ensure an adequate standard of claim documentation, it is desirable that the requirements for claim submittals should be specified at project inception; (iv) the problems with documents assembly, retrieval and access to data can be overcome through the implementation of electronic document management systems; (v) ideological training of personnel to use IT tools and understand the need to change current claims management practice should be undertaken and; (vi) the claims management function should be assigned to a member of the project team specifically trained on large and medium sizes projects.

14.4.0 Recommendations

In order to take advantage of the potential for information technology developments and address the shortcomings of current claims management practice seven main proposals were made to the industry (Chapter Twelve). These proposals were examined by a number of experts and practitioners in industry for their feasibility and suitability. The feedback from this industry review suggests that in order to overcome these problems and take advantage of information technology tools, the following are recommended for implementation:

1. A matrix of records that document site events, resource use and progress of work with respect to scheduled project activity will significantly reduce the difficult of identifying, retrieving, assembling and preparing claims.

2. Standard specifications for preparing and maintaining resource loaded programmes of work should accompany every construction contract as a means aiding claims management.

3. Claims submissions should provide as an obligation a breakdown of costs of delays and disruptions with respect to each project activity.

4. Standard forms should include provisions to incorporate programmes of work. This would lead to better claims management without changing significantly current legal obligations of parties to construction contracts.

5. Training of construction personnel needs to include the use of technology for information management and claims. This is necessary to achieve better claims management within the context to the framework.

6. On medium to large construction projects the claims management function should to personnel trained to deal with them.

7. The possibility of using electronic document management systems to reduce the cost of managing claims relevant documents should be explored. This is because there are

strong indication based on their use in other industries that this technology can improve the contractors' ability to substantiate claims. The EDMS technology has a definite advantage over their current document management practice but its economics in the long term should be investigated and publicised in order to gain general use in the construction industry.

8. Provisions requiring the contractor to keep and allow the employer to audit records and submit the build-up of preliminaries and other bidding documents should be considered as means aiding claims evaluation.

9. The industry should examine carefully the development and implementation of IT tools that can support all aspects of project management on an integrated platform.

It should be emphasised that implementing these recommendations guarantees a solution to one major problem associated with the preparation and settlement of claims: the seemingly intractable question of the availability and accessibility of claims relevant information. The feedback from this research suggests that, if these recommendation are implemented, then at least the information needed to resolve claims and disputes will be available. This means that in all cases, sound judgements can be made by arbitrators and judges. This removes from disputes what the Wood Report referred to as the "*lack of factual evidence to support a claim*"

The recommendation to explore the possible use of IT especially for electronic document management will enable records and costing systems to be implemented which will not only benefit the contractor in claims situations but improve internal information management. The main pay-off will be more informed decision making with respect the contractors' budgetary control and resource management.

14.5.0 Recommendations for further research

It is recommended that further research be carried out in the following areas:

1. To implement the framework proposals on live projects to test their impact on claims management. This is because, although the feedback from industry suggests that the framework was feasible, the result of actual implementation is required to gain general acceptance and further enhance to framework.

2. The standardisation of site activity documentation on construction projects. This is required to address the inadequacies of site records shortcomings identified in case studies (Chapter Seven) and summarised in Chapter Twelve (§§ **12.4.0**).

3. Further work be carried out to development and test of a suite IT applications within the functional scope determined in Chapter Eleven to implement an integrated computer-based system for claims management. This would tackle in practical terms the implementation issues addressed in Chapter Eleven (§§ **11.4.1**) in order to produce practical system.

4. Research be carried to explore the potential of using electronic document management systems to reduce the cost of managing claims relevant documents should be explored. This is because there are strong indication based on their use in other industries that this technology can improve the contractors' ability to substantiate claims. The EDMS technology has a definite advantage over their current document management practice but its economics in the long term should be investigated and publicised in order to gain general use in the construction industry.

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Appendix 1

Appendix 1 - The X^2 Distribution

χ^2-DISTRIBUTION

n	$\alpha = 0·995$	$\alpha = 0·99$	$\alpha = 0·975$	$\alpha = 0·95$	$\alpha = 0·05$	$\alpha = 0·025$	$\alpha = 0·01$	$\alpha = 0·005$	n
1	0·0000393	0·000157	0·000982	0·00393	3·841	5·024	6·635	7·879	1
2	0·100	0·0201	0·0506	0·103	5·991	7·378	9·210	10·579	2
3	0·00717	0·115	0·216	0·352	7·815	9·348	11·345	12·838	3
4	0·207	0·297	0·484	0·711	9·488	11·143	13·277	14·860	4
5	0·412	0·554	0·831	1·145	11·070	12·832	15·086	16·750	5
6	0·676	0·872	1·237	1·635	12·592	14·449	16·812	18·548	6
7	0·989	1·239	1·690	2·167	14·067	16·013	18·475	20·278	7
8	1·344	1·646	2·180	2·733	15·507	17·535	20·090	21·955	8
9	1·735	2·088	2·700	3·325	16·919	19·023	21·666	23·589	9
10	2·156	2·558	3·247	3·940	18·307	20·483	23·209	25·188	10
11	2·603	3·053	3·186	4·575	19·675	21·920	24·725	26·757	11
12	3·074	3·571	4·404	5·226	21·026	23·337	26·217	28·300	12
13	3·565	4·107	5·009	5·892	22·362	24·736	27·688	29·819	13
14	4·075	4·660	5·629	6·571	23·685	26·119	29·141	31·319	14
15	4·601	5·229	6·262	7·261	24·996	27·488	30·578	32·801	15
16	5·142	5·812	6·908	7·962	26·296	28·845	32·000	34·267	16
17	5·697	6·408	7·564	8·672	27·587	30·191	33·409	35·718	17
18	6·265	7·015	8·231	9·390	28·869	31·526	34·805	37·156	18
19	6·844	7·633	8·907	10·117	30·144	32·852	36·191	38·582	19
20	7·434	8·260	9·591	10·851	31·410	34·170	37·566	39·997	20
21	8·034	8·897	10·283	11·591	32·671	35·479	38·932	41·401	21
22	8·643	9·542	10·982	12·338	33·924	36·781	40·289	42·796	22
23	9·260	10·196	11·689	13·091	35·172	38·076	41·638	44·181	23
24	9·886	10·856	12·401	13·848	36·415	39·364	42·980	45·558	24
25	10·520	11·524	13·120	14·611	37·652	40·646	44·314	46·928	25
26	11·160	12·198	13·844	15·379	38·885	41·923	45·642	48·290	26
27	11·808	12·879	14·573	16·151	40·113	43·194	46·963	49·645	27
28	12·461	13·565	15·308	16·928	41·337	44·461	48·278	50·993	28
29	13·121	14·256	16·047	17·708	42·557	45·722	49·588	52·336	29
30	13·787	14·953	16·791	18·493	43·773	46·979	50·892	53·672	30

Source: Hayslett, H.T. (1988). Statistics. Made Simple Books, 228

Appendix 2

NORMALIZATION

Normalization is a technique which is used in a variety of methodologies. It is used in Gane and Sarson (STRADIS), Information Engineering, SSADM, and Multiview. It is a technique that was originally developed by Codd (1970) as part of the development of relational theory and relational databases. However, the technique os normalization si applicable irrespective of whether a relational databse is envisaged or not. It is often used in its own right as an anlaysis technique for the sturcturing of data, it can be used on its own or as a means of crosss-checking or validating orther models, particularly an entity model. In structure systems methodologies, for example Gane and Sarson, it is used to consolidate all the various data stores that have been identified in a data flow diagram into a coherent data structure.

Normalization is the process of transforming data into well formed or natural groupings such that one fact is in one place and that the correct relationships between facts exist. Normalization results in a set of relations.

To illustrate how this works, suppose that a patient has at the end of their bed, a Drug Card showing all drugs prescribed during their stay and the dosage required. Two sample cards, with information typed onto them are shown in **Fig. 1a.** This data could be organised into several ways depending on which requirements we are trying rto satisfy. If we want to simpley recreate the information on the Drug Cand then the organisation of attributes into one table as shown in **Fig. 1b** is ideal - with one retrieval the drug card can be recreated for each patient.

Patient No.: 933 **Surname:** Moneybags **Forename:** Maurice
Wad No.: 10 **Ward Name:** Barnard

Drugs prescribed:

Date	**Drug Code**	**Drug Name**	**Dosage**	**Length of Treatment**
20/5/88	C02355P	Cortisone	2 pills 3 x days after meals	14 days
20/5/88	M03416T	Morphine	Injection every 4 hours	5
25/5/88	M03416T	Morphine	Injection every 8 hours	3
26/5/88	PE8694N	Penicillin	1 pill 3 x day	7

For additional drugs continue on another card

Patient No.: 933 **Surname:** Moneybags **Forename:** Maurice
Wad No.: 10 **Ward Name:** Barnard
Drugs prescribed:

Date	**Drug Code**	**Drug Name**	**Dosage**	**Length of Treatment**
15/5/88	AS473A	Aspirin	2 pills 3 x day after meals	7 days
20/5/88	VA23IM	Valium	2 per day	5

For additional drugs continue on another card

Figure 1a

The Drug Card is our data source and we use as samples, representing all of the drug card data for all patients, the two cards shown in Fig B 1a. It is important to relize we are anlysing all existing data and all possible data associated with the data source chosen (in other words; the sample data may not cover all possibilities so we must look further in our analysis).

Pat No	Surname	Fore-name	Ward No.	Ward name	Prescr Date	Drug Code	Drug Name	Dosage	Lgth treat
923	Moneybags	Maurice	10	Barnard	20/5/88	CO2355P	Cortisone	2 pills 3x day after meals	14
923	Moneybags	Maurice	10	Barnard	20/5/88	MO3416T	Morphine	Injection every four hours	5
923	Moneybags	Maurice	10	Barnard	25/5/88	MO3416T	Morphine	Injection every 8 hours	3
923	Moneybags	Maurice	10	Barnard	26/5/88	PE6894N	Penicillin	1 pill 3 x day	7
109	Foot	Ivor	11	Fleming	15/5/88	AS473A	Aspirin	2 pills 3 x day after meals	7
109	Foot	Ivor	11	Fleming	20/5/88 .	VA123M	Valuim	2 per day	5

Figure 1b Possible (unnormalised) Table designed for the Drug Card

When we look at the data in the table there seems to be considerable unnecessary duplication: Moneybags appears four times, Ward Name and Drug Name have the same value appearing several times. This duplication means that some apparently very simple, queries will be rather inefficient and difficult to perform. For example:

- How may patients are there in the hospital?
- How many patients in Ward 10 have been given morphine?

When we come to update the data in Figure. 1c, there will problems. For example:

If Foot dies and is deleted we lose important information (that Ward 11 is called Fleming and that Valium is VA231M). If Moneybags is moved from Ward 10 to 11 we need to find each row connecting Moneybags to Ward 10 and change it otherwise we will get an inconsistent result when we query the data. This problems can be avoided by organising the data into 'well-normalised' tablee.

To build these well-normalised relations the anlyst take the raw system's data going through several stages of normalisation known as normal forms.

Unnormalised Form

↓

First Normal Form

↓

Second Normal Form

↓

Third Normal Form

Figure 1c: The Structure Data Normalisation

How to perform relational data analysis

Relational data analysis can be applied to any set of attributes. One could, theoretically, take all of the attributes of the system, analyse them, and produce a data design for the system all in one step. In practice this is almost impossible to do (unless the system is very small) since it involves comparing every attribute with every other. The practical approach taken in SSADM is to analyse separately small 'chunks' of the system data and then synthesize the results of each separate analysis. The 'chunks' of data selected! for analysis are often referred to as *data sources*. Normally the inputs and outputs from the system are used; these could be forms, screen formats, or reports.

1. *Represent the data in unnormalized form and pick a key* The first step is to represent all of the data in a table. Some of the column headings (attribute names) have been abbreviated to save space. As the dates given on the Drug Card are the dates on which the particular drug was prescribed we have renamed Date to the more meaningful Prescription Date. Note that the table is not strictly speaking a relation since there are several possible values for, say, patient 923's Drug Code.We can select any attribute or combination of attributes to act as primary key. However, it makes the analysis rather more straightforward if a 'reasonable' key is selected. Criteria for selecting a reasonable key are:ideally the key should be unique (only one possible value) for the particular data source; use the smallest combination of attributes possible; avoid textual keys.

The Patient No. is a good choice of key since each Drug Card is for one and only one patient, and the other criteria are satisfied. The convention is that primary keys are underlined. Figure 1d shows the Drug Card data in unnormalized form.

Pat No	**Surname**	**Fore-name**	**Ward No.**	**Ward name**	**Prescr Date**	**Drug Code**	**Drug Name**	**Dosage**	**Lgth treat**
923	Moneybags	Maurice	10	Barnard	20/5/88	CO2355P	Cortisone	2 pills 3x day after meals	14
				Barnard	20/5/88	MO3416T	Morphine	Injection every four hours	5
				Barnard	25/5/88	MO3416T	Morphine	Injection every 8 hours	3
				Barnard	26/5/88	PE6894N	Penicillin		7
109	Foot	Ivor	11	Fleming	15/5/88	AS473A	Aspirin		7
					20/5/88	VA123M	Valuim		5

Fifure 1d Drug Card data in unnormalized form

2. *Represent the data in First Normal Form by removing any repeating groups of attributes to separate relations. Pick keys for any, relations identified A repeating group* is defined as any *attribute or group of attributes* that may occur with multiple *values* for a *single value of the primary key attribute.*

Thus in the table there are several values of Drug Code, Drug Name, Prescription Date, Dosage, and Treatment Length for one value of the Patient No. These attributes form a repeating group and are removed to a separate relation.

The new relation has the column headings Patient No., Drug Code, Drug Name, Prescription Date, Dosage, and Treatment Length. The Patient No. is required to make each row unique across the whole of the system data; it is quite likely that two patients could be given exactly the same prescription on the same day.

We now have to decide on the primary key of the new relation. This will always be a combination of the key selected in step I and one or more additional attributes necessary to identify a particular row. Patient No. is therefore part of the key and further analysis shows that it is necessary to have both Drug Code and Prescription Date included in the key. (A patient may be prescribed several drugs on the same day or may be prescribed same drug on separate occasions.) When several attributes are required for the key of a relation this is known as a *compound key*. The new relation has a compound key of Patient No., Drug Code, and Prescription Date. (This assumes a hospital rule that a patient cannot be given different dosages of the same drug several times in the same day. What could the key be if there was no such rule?)

Pat No	Prescr Date	Drug Code	Drug Name	Dosage	Lgth treat
923	20/5/88	CO2355P	Cortisone	2 pills 3x day after meals	14
923	20/5/88	MO3416T	Morphine	Injection every four hours	5
923	25/5/88	MO3416T	Morphine	Injection every 8 hours	3
923	26/5/88	PE6894N	Penicillin	1 pill 3 x day	7
109	15/5/88	AS473A	Aspirin	2 pills 3 x day after meals	7
109	20/5/88	VA123M	Valium	2 per day	5

Figure1d-1: Separated repeating group now in First Normal Form

With the repeating group removed to a separate relation, we now consider the attributes left behind. These are the attributes that do not repeat for a single value of the key selected in step 1. Each row is therefore uniquely identified by the value of the key previously selected.

Thus Patient No., Surname, Forename, Ward No., and Ward Name remain as a relation with a key of Patient No. This is shown in Fig. 4.39. The data is now represented by two tables in First Normal Form (Figure1d and 1e).

Pat No	Surname	Fore-name	Ward No.	Ward name
923	Moneybags	Maurice	10	Barnard
109	Foot	Ivor	11	Fleming

Figure 1e Non-repeating information in First (and Second) Normal Form

3. *Represent the data in Second Normal Form by removing any attributes that depend upon part of the key to separate relations* This only affects relations that compound keys. We have to decide whether any attributes in a compound key rel are dependent on only part of that compound key.

This concept of dependency, often referred to as *functional dependency, is* v important in relational data analysis. For any two attributes A and B, A is dependent on B if and only if: For a given value of B there is associated with it precisely one value of A at any one time.

Thus the attribute Patient Surname is dependent on the attribute Patient No. since given value of Patient No., say 923, there is associated with it precisely one value Patient Surname, in this case Moneybags.

Another way of describing this is to say that: Attribute B *determines* attribute A Patient No. *determines* Patient Surname Notice that the opposite is false: Patient Surname *does not determine* Patient No. For a given value of Patient Surname, say

Moneybags, there may be several associated values of Patient No., as there may be several patients called Moneybags in the hospital at the same time.

Functional dependency diagrams (Figure 2f and 2g) are a useful way of understanding dependency and of sorting out complex dependencies. An arrow is drawn from the determining attribute(s) to the dependent attribute. Figure 2f emphasizes common-sense view of dependency: if you know the Patient No, then you can find the Patient Surname.

atientNo.

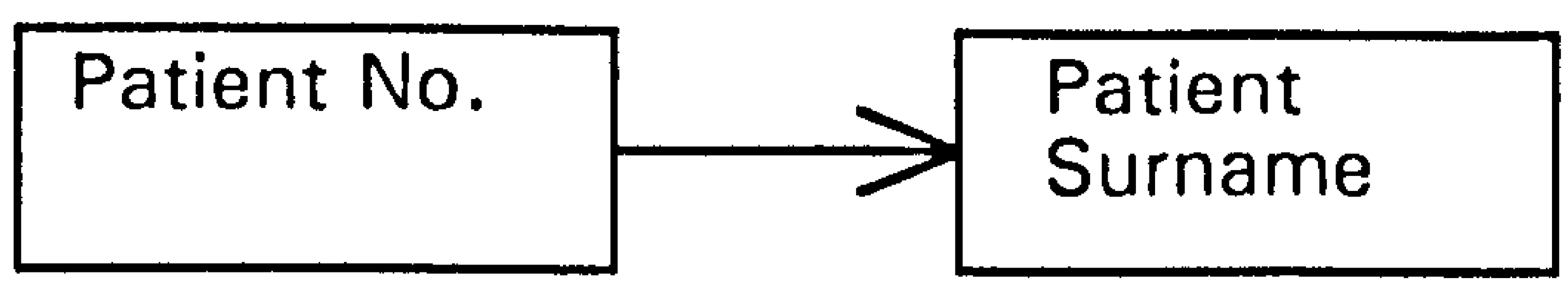

Figure. 2f Functional dependency diagram: Patient No. detertermines Patient Surname

Dependency can also occur with groups of attributes. In the table shown in Fig. 2h the combination of attributes-Patient No., Prescription Date, and Drug Code deterinines each of the attributes-Dosage and Treatment Length. This compound key relation can also be shown by a dependency diagram as in Fig. 2g below.

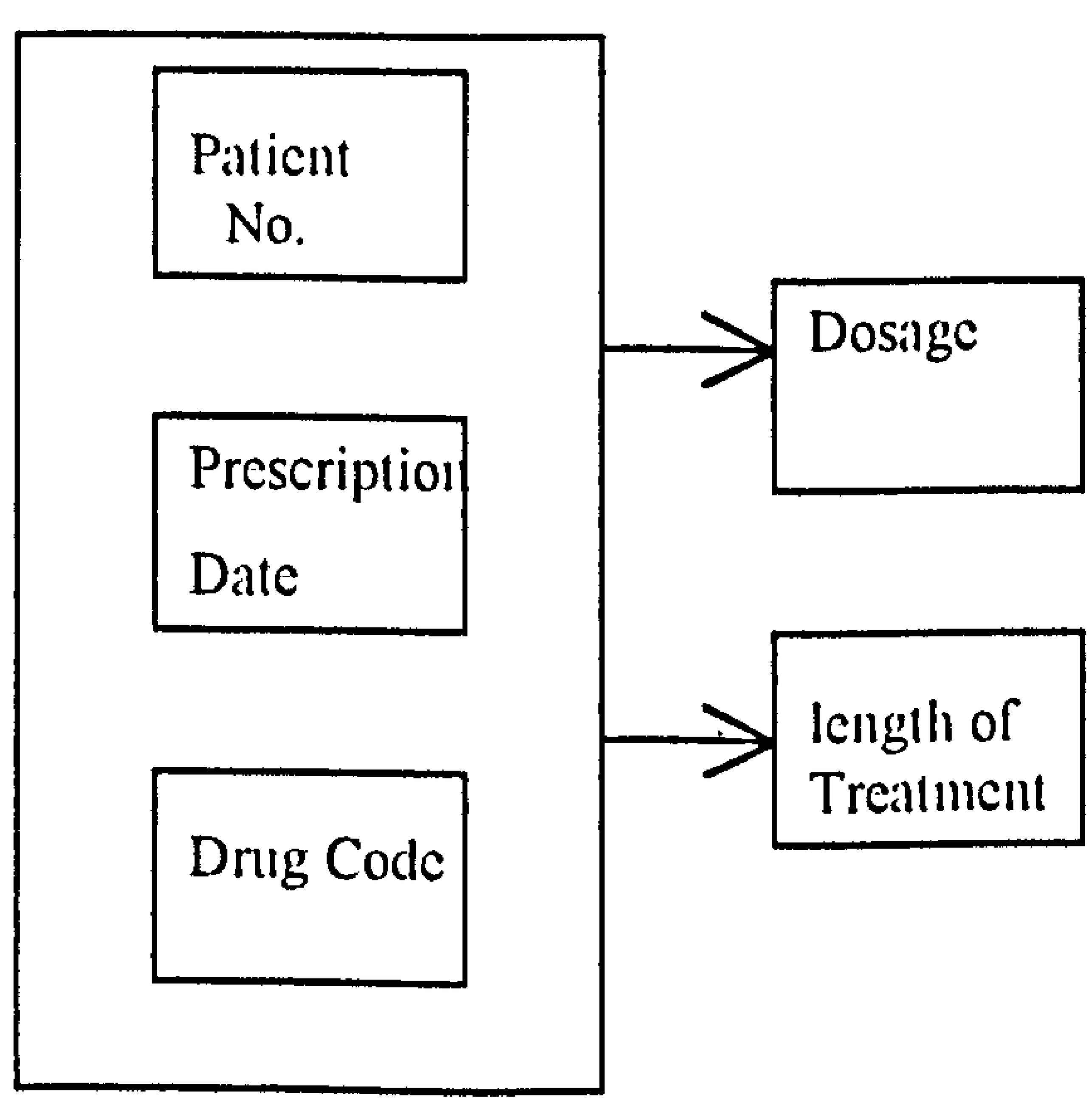

Fig. 2g Functional dependency diagram showing a compound key relation

To put a relation into Second Normal Form we check that each attribute in the relation depends on the whole key of the relation that it is in. Any attributes not depending on the whole key are removed to separate relations using their determining attributes as primary key.

The First Normal Form relation, shown in Fig. 2d above, includes the attribute Drug Name. This is only determined by the Drug Code. Thus the relation is not in Second

Pat No	Prescr Date	Drug Code	Dosage	Lgth treat
923	20/5/88	CO2355P	2 pills 3x day after meals	14
923	20/5/88	MO3416T	Injection every four hours	5
923	25/5/88	MO3416T	Injection every 8 hours	3
923	26/5/88	PE6894N	1 pill 3 x day	7
109	15/5/88	AS473A	2 pills 3 x day after meals	7
109	20/5/88	VA123M	2 per day	5

Fig. 2h : Second Normal Form relations from the Drug Card

The systematic way of deciding whether there are any part-key dependencies is to go through each compound key relation and ask of each attribute:

Does it depend on the whole key?

If the answer is *No* then which attribute(s) it depends upon must be decided. An additional relation is created with the determining attribute(s) as the key and the dependent attribute(s) as the data. The dependent attributes are removed from the original relation.

In the example Drug Name is only dependent on Drug Code, so an additional re is created with Drug Code as key and Drug Name as data. Drug Name is removed the original relation.

Note that we should also examine the key attributes and ask for a compound whether any parts of the key directly depend on other parts of the key? If any the key are dependent on other parts then the dependent attributes should be rele non-key attributes with the determining attributes remaining as keys. In the case compound key in the hospital example there is no dependency within the key. Any relations that have single keys are not affected by step 3. They are Second Normal Form.

4. Represent the data in Third Normal Form by removing any attributes not dependent on the key to separate relations This step is similar to the previous that we are looking at dependency between attributes. The difference is that here looking for attributes that might be dependent on other attributes instead of I non-key attributes that might be dependent on only part of the key. Therefore for each attribute we should ask the questions:

Is the attribute directly dependent on the key attribute(s) of the relation it is in? and
Is it directly dependent on any other attribute(s) in the system?

If the answer to the first question is *No* then the answer to the second must These two questions act as a cross-cheek on each other in trying to find an inter-data dependencies. These are always difficult to find since to asl question systematically we would have to compare each attribute in the every other attribute or combination of attributes. This systematic approach impossible in practice so a more intuitive approach has to be taken. I approach relies on the analyst's skill and knowledge of the system in bein possible inter-data dependencies and then to investigate them formally. I the inter-data dependencies will be obvious and will occur within the re analysed together-it is those rare cases where a dependency occurs betw analysed on separate data sources that are hard to find.' If an inter-data dependency is detected, say between attributes A and B, the decide whether attribute A determines attribute B or vice versa. The following should be asked:

The technically minded reader should note that these questions ensure that the relations are in Bo Normal Form, sometimes referred to as Strong Third Normal Form. These basic principles applied to the records collected during the case studies yielded the rationalised forms proposed in chapter Twelve. The results of the normalisation is shown in the next section.

Result of Normalisation

1. Request For Approval

UNF	FNF	SNF	TNF
Req. No.	Req. No.	Req. No.	**Contractor(R)**
Contract No.	Contract No.	Contract No.	Contract No.
Address	Address	Address	Req. No.
Date	Date	Date	Date
Contract Name	Contract Name		
Request		Contract No.	**Arch/Engineer(R)**
Signature/cont.	Contract No.	Name	Name
Reply	Name	Reply	Contract No.*
Signature/Arc/Eng	Reply	Signature/Arc/Eng	Address
Date	Signature/Arc/Eng	Designation	Desigantion
Name	Date		
Designation	Designation	Name	**Request for Approval**
Comment	Comment	Request	Req. No.
		Signature/cont.	Name*
	Contract No.	Comment	Request
	Name		Reply
	Request		Comment
	Signature/cont.		
	Comment		

2. Site Daily Diary

UNF
Serial No.
Contract
Engineer
Location/Section
Day
Weather
Date
Labour
No.
Total Manhours
Plant
Type
Total hours
Particulars
Details
Inspected by
Signature
Agent
Comment

FNF
Serial No.
Contract
Engineer
Location/Section
Day
Weather
Date

Serial No.
Date
Particulars
Details
Inspected by
Agent
Signature

Date
Labour No.
Total Manhours
Plant type
Total Hours

SNF
Serial No.
Contract Name
Location/Section
Weather

Serial No.
Contract Name
Engineer Name
Day
Date

Contract Name
Engineer Name
Date
Particulars
Details
Agent

Engineer Name
Date
Labour No.
Total Manhours
Plant Type
Total Hours

TNF
Project Details
Serial No.
Contract Name
Location/Section
Weather

Contractor
Serial No.*
Contract Name
Day
Date

Engineer
Contract name*
Engineer Name
Particulars
Details
Designation

Site Agent
Engineer Name*
Date
Agent

Resource Allocation
Date*
Labour No.
Total Manhours
Plant Type
Total Hours

3. Daily Record

UNF
Sheet No.
Contract No.
Contract Name
Daily record
R.E. Inst. No.
Date
Description
Name
Trade/Function
No.
Time On
Time Off
Allocation No.
Details of Work
Materials Description
Quantity
Unit
Plant
Description
Rating
No.
Time On
Time Off
Signature/Cont
Signature/Daily Record
For
Date

FNF
Sheet No.
Contract No.
Contract Name
R.E. Inst. No.
Date

Labour Name
Description of Work
Trade/Function
No.
Time On
Time Off
Details of Work

Plant Type
Description
Rating
No.
Time On
Time Off

Allocation No.
Materials Description
Quantity
Unit
Signature/Cont
Signature/Daily Record
For
Date

SNF
Sheet No.
Contract Name
Contract No.
R.E. Inst. No.
Date

Sheet No.
Contract Name
Labour Name
Description of Work
Trade/Function
No.
Time On
Time Off
Details of Work

Contract Name
Labour Name
Plant Type
Plant Description
Rating
No.
Time On
Time Off

Labour Name
Allocation No.
Materials Description
Quantity
Unit
Date

TNF
Record Details
Sheet No.
Contract Name
Contract No.
R.E. Inst. No.
Date
Details of Work

Labour Details
Labour Name
Contract Name*
Description of Work
Trade/Function
No. of Labour
Time On
Time Off

Plant Details
Plant type
Labour name*
Plant Description
Rating
No.
Time On
Time Off

Materials details
Allocation No.
Plant type*
Materials Description
Quantity
Unit

4. Period Cost Report

UNF
Contract No.
Contract name
Operation Code No.
Description
Cost Labour & Plant
Cost Material
Cost Sub-contract
Total Cost
Allowance
Adjustments
Adjustment Allowance
Result
Percent
Operation Cost Code
Net Totals
Av. Overheads
Av. Profit
Gross total

FNF
Contract No.
Contract Name
Net Totals
Av. Overheads
Av. Profit
Gross total

Operation Code No.
Description
Cost Labour & Plant
Cost Material
Cost Sub-contract
Total Cost

Operation Code No.
Allowance
Adjustments
Adjustment Allowance
Result
Percent

SNF
Contract No.
Contract Name
Net Totals
Av. Overheads
Av. Profit
Gross total

Contract No.
Operation Code No.
Description
Cost Labour & Plant
Cost Material
Cost Sub-contract
Total Cost
Allowance
Adjustments
Adjustment Allowance
Result
Percent

TNF
Contractor
Contract No.
Contract Name

Accounts Cost Report
Contract Name
Contract No.*
Net Totals
Av. Overheads
Av. Profit
Gross total

Individual Oper. Cost
Contract No.*
Operation Code No.
Description
Cost Labour & Plant
Cost Material
Cost Sub-contract
Total Cost
Allowance
Adjustments
Adjustment Allowance
Result
Percent

5. Instructions to Sub-Contractor

UNF

Contract No.
Contract Address
Date
Our Order No.
Inst. Record No.
Name
Sub-Contractor
Address
Comment

Commence Date
Complete date
Proj.Man/Agent Sign

FNF

Contract No.
Contract Address
Date
Our Order No.

Inst. Record No.
Name

Sub-Contractor
Address
Comment
Commence Date
Complete date
Proj.Man/Agent Sign

SNF

Contract No.
Order No.
Contract Address
Date

Contract No.
Inst. Record No.

Order No.

Comment
Commence Date
Complete date

Contract No.
Inst. Record No.
Order No.
Name
Sub-Contractor
Address

TNF

Contractor(R)
Contract No.
Order No.
Contract Address
Date

Instruction

Inst. Record No.

Contract No.*
Comment

Order Details(R)
Order No.
Inst. Record No.*
Commence Date
Complete date

Sub-Contractor
Sub-Contractor Name
Sub-Contractor
Address

6.Plant and Labour Allocation Sheet (Not required)

The data C/Hand(FNF) is changed to Site engineer because he is involved in this process as the supervising officer on site. This will enable information flow when rationalising the TNF.

UNF

Contract No.
Contract name
C/Hand
Signature
Date
Trade
Agent/GF
Siganture/GF
Check No.
Operative name
Trade
Total Hours
Plant Used
Description of Work

FNF

Contract No.
Contract name
Site Engineer
Signature
Date
Trade
Agent/GF

Check No.
Operative name
Trade
Total Hours
Plant Used
Description of Work

SNF

Contract No.
Contract name
Site Engineer

Contract No.
Date
Trade
Agent/GF
Site Engineer

Contract No.
Date
Check No.
Operative name
Trade
Total Hours
Plant Used
Description of Work

TNF

Contractor
Contract No.
Contract name

Site Agent
Date
Contract No. *
Trade
Agent/GF
Site Engineer

Resource Allocation
Contract No.*
Check No.
Description of Work
Operative name
Trade
Total Hours
Plant Used

7. Cornfirmation of Verbal Instruction

UNF	FNF	SNF	TNF
Ref. No.	Ref. No.	Ref. No.	**Contractor**
Address	Instruct. No.	Instruct. No.	Ref. No.
Date	Date	Date	Date
Instruct. No.	Contract name	Contract name	Contract name
Contract name			
Consult. Engineer	Instruct. No.	Ref. No.	**Confirnation of Instruct.**
Day	Consult. Engineer		Ref. No. *
month	Day		Instruct. No.
Year	month		Consult. Engineer
	Year		Day
			month
			Year

8. Operations Time Sheet(redundant)

UNF	FNF	SNF	TNF
Contract No.	Contract No.	Contract No.	**Contractor**
Contract Name	Contract Name	Contract Name	Contract No.
Weekending date	Weekending date		Contract Name
Completed by	Completed by	Contract No.	
Signature	Approved by	Weekending date	**Approval(internal)**
Approved by	Position	Completed by	Contract No.*
Position		Approved by	Weekending date
Clock No.		Position	Completed by
Name	Clock No.		Approved by
Trade	Name	Weekending date	Position
Actual daily hours	Trade	Clock No.	
Total Actual Hours	Actual daily hours	Name	**Operative**
Total with Prem. Time	Total Actual Hours	Trade	Name
Bonus/hour	Total with Prem. Time	Actual daily hours	Weekending date*
Travel Allowance	Bonus/hour	Total Actual Hours	Trade
Tool/Condition money	Travel Allowance	Total with Prem. Time	
Other Payments	Tool/Condition money	Bonus/hour	
	Other Payments	Travel Allowance	
		Tool/Condition money	
		Other Payments	**Actual Hours**
			Clock No
			Name*
			Actual daily hours
			Total Actual Hours
			Total with Prem. Time
			Bonus/hour
			Travel Allowance
			Tool/Condition money
			Other Payments

9. Foreman's or Ganger's daily return(redundant)

Changed Working Hours(FNF), to plant owner to establish easily plant ownership

UNF	FNF	SNF	TNF
Contract No.	Contract No.	Contract No.	**Contractor**
Contract Name		Contract Name	Contract No.
Check No.	Check No.		Contract Name
Name	Name	Contract No.	
Trade	Trade	Check No.	**Labour Allocation**
Time started	Time started	Name	Contract No.*
Time Finnished	Time Finnished	Trade	Check No.
Total Hours	Total Hours	Time started	Name
Foreman/Ganger's	Date	Time Finnished	Trade
name			
Date		Total Hours	Time started
month	Name	Date	Time Finnished
Year	Operative No.		Total Hours
Operative No.	Operation Description	Contract No.	Date
Operation Description	Plant used Type	Check No.	
Working hours	Plant used No.	Operative No.	**Plant Details**
Verified	Plant Owner	Operation Description	Labour Name
Agent	Working Hours	Plant used Type	Check No.*
General foreman	Agent	Plant used No.	Operation Description
Time	Gen. Foreman	Plant Owner	Plant used Type
Operation No.			Plant used No.
Plant used Type		Contract No.	Plant Owner
No. Plant used		Check No.	
Plant Owner		Operative No.	**Resource allocation**
		Working Hours	Operative No.
		Agent	Working Hours
		Gen. Foreman	Agent
			Gen. Foreman

10. Sfaff Overtime Voucher

UNF	FNF	SNF	TNF
Contract No.	Contract No.	Contract No.	**Contractor**
Employee No.	Site	Site	Contract No.
Name	RECD	Checked	Site
Site	Approved		
Approved by	Checked	Contract No.	**Staff Overtime**
Approved Director	Passed to	Employee No.	Employee No.
O. Day	Comment	Name	O. Day
O. Date		O. Day	O. Date
Hours From	Employee No.	O. Date	Hours From
Hours To	Employee Name	Hours From	Hours To
RECD	O. Day	Hours To	
Approved	O. Date		**Staff Record**
Checked	Hours From	Contract No.	Employee No.*
Passed to	Hours To	Employee No.	Employee Name
Comment		Employee Name	Comment
		Comment	RECD
		RECD	Approved
		Approved	Passed To
		Passed To	

11. Request For information/Technical Query

UNF	FNF	SNF	TNF
Query No.	Query No.	Query No.	**Query**
Contract No.	Contract No.	Date	Query No.
Contract Name	Contract Name	Infor. request	Date
Date	Date	Reply to query	Infor. request
Engineer Address	Infor. request	Require name	Reply to query
Signature	Reply to query		Require name
Date	Require name	Query No.	
Engineer name	Signature/Cont	Contract No.	**Contractor**
Designation		Contract Name	Query No.*
Infor. request	Engineer name		Contract No.
Reply to query	Designation	Query No.	Contract Name
Require name	Engineer Address	Contract No.	
Signature/Cont	Date	Engineer name	**Engineer**
	Signature	Designation	Query No.*
		Engineer Address	Engineer name
		Date	Designation
			Engineer Address
			Date

12. Confirmation of Receipt of Instruction

UNF	FNF	SNF	TNF
Ref. No.	Ref. No.	Ref. No.	**Confirmation**
Date	Date	Date	Ref. No.
Contract No.	Contract No.		Date
Contract name	Contract name	Ref. No.	
Contrac Rep. Name		Contract No.	**Contractor**
Engineer Name	Contract No.	Contract name	Contract No.
Date	Contract name	Contrac Rep. Name	Contract name
Engineer Address	Contrac Rep. Name		Contrac Rep. Name
		Ref. No.	
	Engineer Name	Contract No.	**Engineer**
	Engineer Address	Engineer Name	Engineer Name
	Date	Engineer Address	Engineer Address
		Date	

13. Claims Report(created as output for the claims management system)

UNF	FNF	SNF	TNF
Claim No.	Claim No.	Claim No.	**Contractor**
Contract Name	Contract Name	Contract Name	Contract Name.
Appendices	Event Narrative	Event Narrative	Claim No.*
Event Narrative	Contract Clause	Contract Clause	Event Narrative
Contract Clause	Time Ext. Granted		Contract Clause
Activity ref.	Damages	Claim No.	
Activity	Labour	Contract Name	**Claims**
Actual Start Date	Plant	Time Ext. Granted	Claim No.
Planned start date	Materials	Damages	Time Ext. Granted
Actual Finnish Date	Preliminaries	Labour	Labour
Planned Finnish Date	Supervision	Plant	Plant
Effect on Activity	Interest	Materials	Materials
Time Ext. Granted	Head Office Overhead	Preliminaries	Preliminaries
Damages		Supervision	Supervision
Labour	Activity Ref.	Interest	Interest
Plant	Activity	Head Office Overhead	Head Office Overhead
Materials	Actual Start Date		
Preliminaries	Planned start date	Claim No.	
Supervision	Actual Finnish Date	Contract Name	**Activity**
Interest	Planned Finnish Date	Activity Ref.	Claim No.*
Head Office Overhead	Effect on Activity	Activity	Activity Ref.
		Actual Start Date	Activity
		Planned start date	Actual Start Date
		Actual Finnish Date	Planned start date
		Planned Finnish Date	Actual Finnish Date
		Effect on Activity	Planned Finnish Date
			Effect on Activity

Appendix 3

Appendix 3- Dataflow Diagrams Using SSADM

Components of Data Flow Diagrams

External entities

An external entity is whatever or whoever donates information receives information from it. All information represented within a system must have been obtained initialy from an external entity. An external entity is represented on a Data Flow Diagram as an oval containing the name and an identifier. The convention is that the identifier is a lower-case letter, as shown in Fig. A 1a. An external entity may be a user of the system, an external organization, a computer system, or any other source or recipient of information,

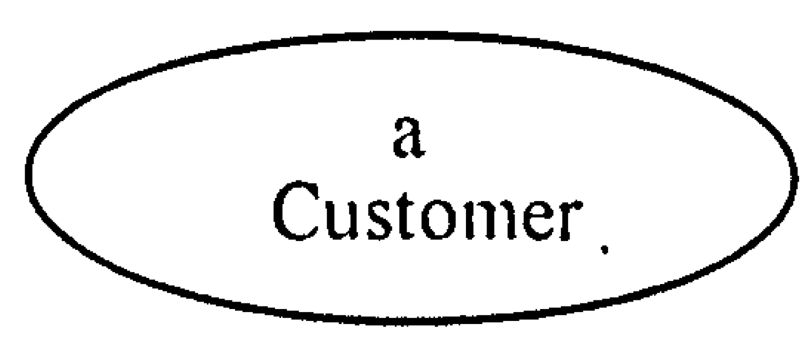

Fig. A 1a Notation for external entities

Process

A process transforms or manipulates data within the system. Processes are represented by rectangles on a Data Flow Diagram. Each process box contains the name of process an identifier, and possibly a location:

* The process name is an imperative statement: 'do this' or 'do that'. It describes the processing performed on the data received by the process. For example, a process may be named 'Register new customer', but may not be named 'Manager or 'Registration Section'.
* Process identifiers are numerical.
* In the Current Physical Data Flow Diagrams, the location of the process is placed at the top of the box. This might be a physical location, but is more often used

to denote the staff responsible for performing the process, The Logical and Required System Data Flow Diagrams do not show the locations of the different processes.

Figure A 1b shows where each of these elements are placed in a process box.

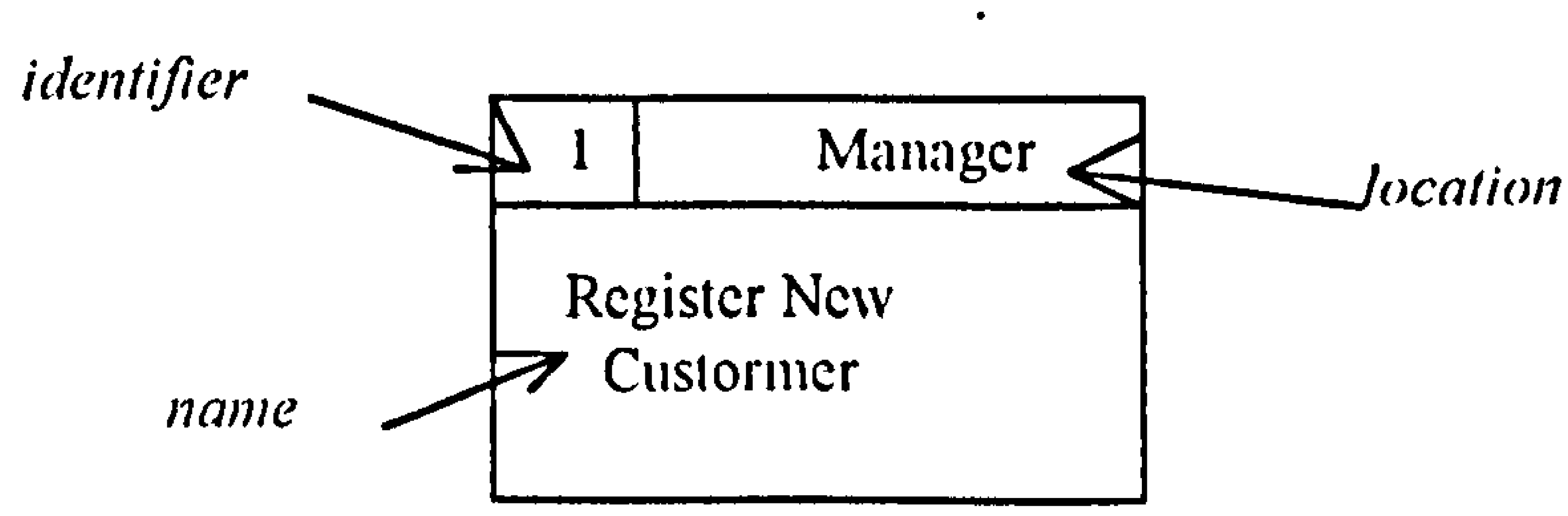

Fig. A 1b Notation for processes in Data Flow Diagrams

Data store

A data store is where information is held for a time within the system. A data store is represented on a Data Flow Diagram by an open-ended box as shown in Fig. A 1c

Fig A 1c Notation for data stores

In the Current Physical Data Flow Diagrams, the data stores represent real-world stores of information such as computer files, card indexes, ledgers, etc. Manual data stores are shown on these physical diagrams by using the identifier, 'M'; computer-based data stores are shown by using the identifier, 'D'. In contrast to these main stores where data is held permanently, transient data stores hold data for a short time before it is used. Transient stores are identified by a 'T', if they are also manual then 'T(M)' is used. In the Logical and Required System Data Flow Diagrams, each main data store is regarded as computerized and identified by a 'D'. Some transient stores may remain and retain their 'T' identifier.

Dataflow

A data flow represents a package of information flowing between objects on the Data Flow Diagram. A data flow is represented by a line and an arrow to denote the direction of the flow of information. It is labelled with the name or details of the information represented by the data flow. Figure A 1d illustrates data flows on a Current Physical Data Flow Diagram.

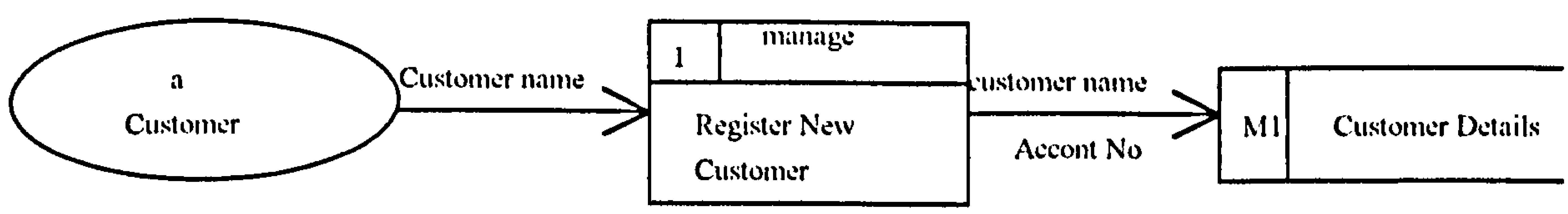

Fig. 1d Data flows on a Current Physical Data Flow Diagram

Points to note about data flows are:

* Information always flows to or from a process. The other end of the flow may be an external entity, a data store, or another process.

* Occasionally there are relevant data flows between external entities. Though, strictly speaking, these are outside the system; it can make the diagram more understandable if they are shown. The convention is to use a dashed line for these external data flows.

* In the Current Physical Data Flow Diagrams, the data flows represent real-world flows of infortnation. For example, these could be forms sent from one part of the system to another or telephone conversations between someone within the system and a customer.

* In the Logical and Required Data Flow Diagrams, these flows represent the attributes required by a process or an output from a process.

Construction of Data Flow Diagrams

The top-level Required System Data Flow Diagram of a simple banking system is shown in Fig. A 1e. Here, the main activities are the registration of new customers, the recording of deposits or withdrawals, and the closing of accounts. New customers are registered and accounts are closed by the bank manager, represented here as an external entity. When an account is closed, the customer is notified by the system. Cash deposits into the account are made by the customer, and salary cheques are paid in by the employer. The bank clerk performs a balance check before allowing a withdrawal by the customer at the bank counter. Notice the external flows (shown by dashed lines) between Customer and Clerk indicating the information passing before entry into the computer system.

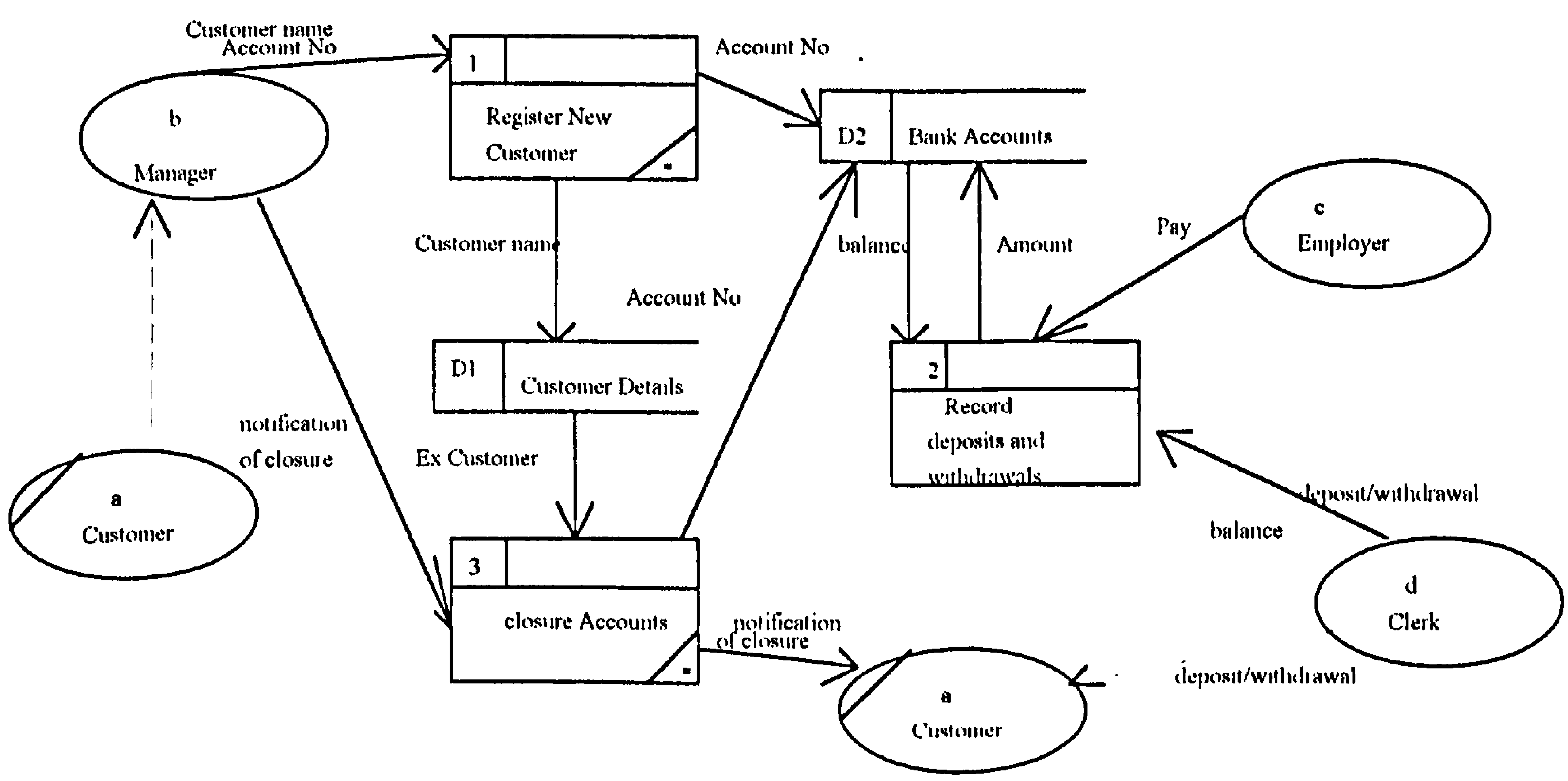

Fig. A 1e Example Data Flow Diagram for Cash & Grabbs Bank

Some general principles about Data Flow Diagrams arise from Fig. A 1e

External entities

It is sometimes difficult to decide exactly where the system boundary lies. In the early stages of analysis the boundary should be wide to ensure that all possibilities are explored. So when investigating the current physical system the current operators are normally shown inside the boundary as part of the processes (usually named in the 'location'). Figure A 1d shows the current physical version of Process 1 in Fig. A 1e (which is the required system). In the current system, the manager is performing the Process 'Register New Customer', so is shown in the location area of the process box.

The external entity is the customer.

The logical view of this is also that the customer is the external entity for the process 'Register New Customer'; since he or she is the 'owner' of the information and could conceivably be directly responsible for input into the computer. Our feeling is that it is best to keep the boundary wide when developing the Logical Data Flow Diagrams and so avoid constraining possible designs later. The Required System Data Flow Diagrams show the design of the automated system. Thus Fig. A 1e above shows the manager as the external entity as he or she is responsible for entering the information into the computer system. The customer is shown, via a dashed external data flow, supplying the manager with the information. We could have designed the system differently and allowed the customer to enter their details directly; there would then be a direct flow into the process from the customer. We have also used a dashed data flow to describe the interaction the clerk has with the customer for a deposit or withdrawal. Further details of the Current Physical, Logical, and Required System Data Flow Diagrams are given in Secs 3.4, 3.6, and 4.2 respectively.

Process numbering

Although the processes are numbered sequentially, this does not imply that they are executed in any particular sequence. Data Flow Diagrams do not imply sequence.

Processes 1, 2, and 3 could be renumbered in another sequence and remain meaningful. Even where a process-to-process data flow exists, this need not imply that the second process must wait for the first to end before it begins.

Duplication of data stores and external entities

It has been necessary to duplicate certain external entities and data stores to avoid overcomplicating the diagram with crossing lines. To denote that a particular data store has been duplicated in the diagram, an extra vertical line is placed at the left side of the box. Duplicated external entities are denoted by an oblique bar to one side of the oval, as in the Customer external entity in Fig. A 1e. Where objects are duplicated, it is easy to make mistakes in rewriting the names of the objects wherever they occur. If identifiers are present we can easily reconcile different appearances of the same objects.

Layout of the diagram

To make the diagram more readable, the external entities have been arranged around the edges of the diagram, and the data stores placed towards the centre of the diagram. This is good practice rather than a particular rule. For clarity, no more than 12 processes should be shown on a single Data Flow Diagram. It is important to remember that one of the main purposes of a diagram is to act as a means of communication, so legibility and clarity are as important as the technical content of a diagram.

Levels of Data Flow Diagrams

Each process on a Data Flow Diagram may be broken down into several processes which are shown on another Data Flow Diagram. This is described as decomposing the Data Flow Diagrams. The Data Flow Diagram which is a result of this decomposition is one level below the Data Flow Diagram containing the original process.

The Data Flow Diagram that describes the entire system within a single diagram is the 'top-level' or 'level 1' Data Flow Diagram. The Data Flow Diagrams that are expansions of processes at the top level are 'level 2' Data Flow Diagrams (see Fig. A 1f). Levels below this are called 'level 3', 'level 4', etc. Processes that are not further decomposed are 'bottom-level' processes. Processes from the top-level Data Flow Diagram may be broken down to a number of levels if they are complex or may not be broken down at all if they are relatively simple. Thus, it is possible to have bottom-level processes appearing at all levels of the Data Flow Diagrams. Bottom-level processes are shown on the diagrams by marking them with a '*' as Processes 1 and 3 in Fig A 1e and all the processes in Fig. A 1g.

If a process is decomposed, the identifiers of the lower-level processes are prefixed by the identifier of the higher-level process. For example, if Process 5 is decomposed, the lower-level processes will be identified as 5.1, 5.2, etc. Similarly, if Process 5.1 is subsequently decomposed, the lower-level processes will be 5.1.1, 5.1.2, and so on.

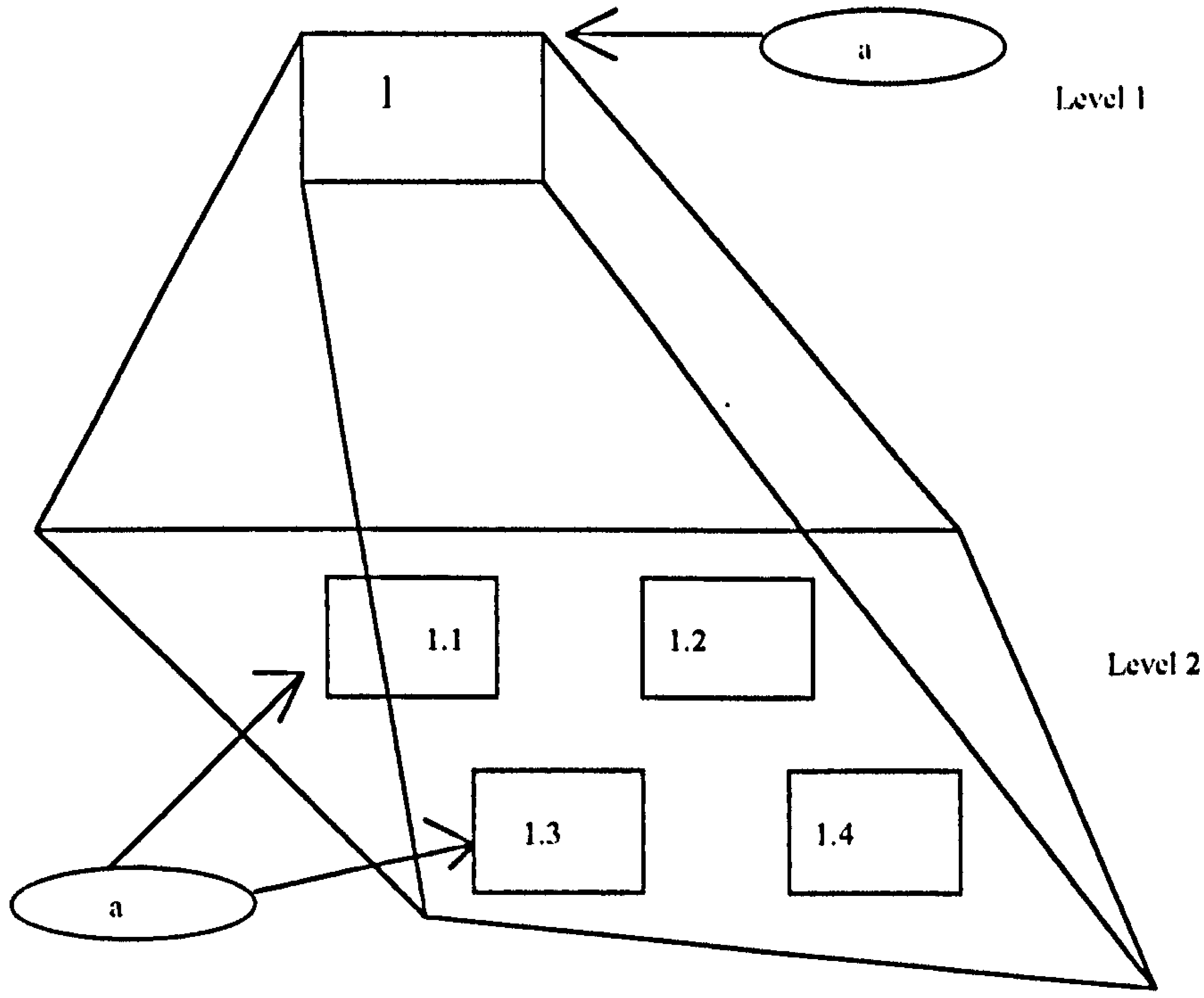

Fig. A 1f Decomposition of processes and data flows in Data Flow Diagrams

Notice that data flows also decompose as we go down the levels of Data Flow Diagrams; the level I flow 'a-I' in Fig. A 1f splits into two flows, 'a-1.1' and 'a1.3', at level 2.

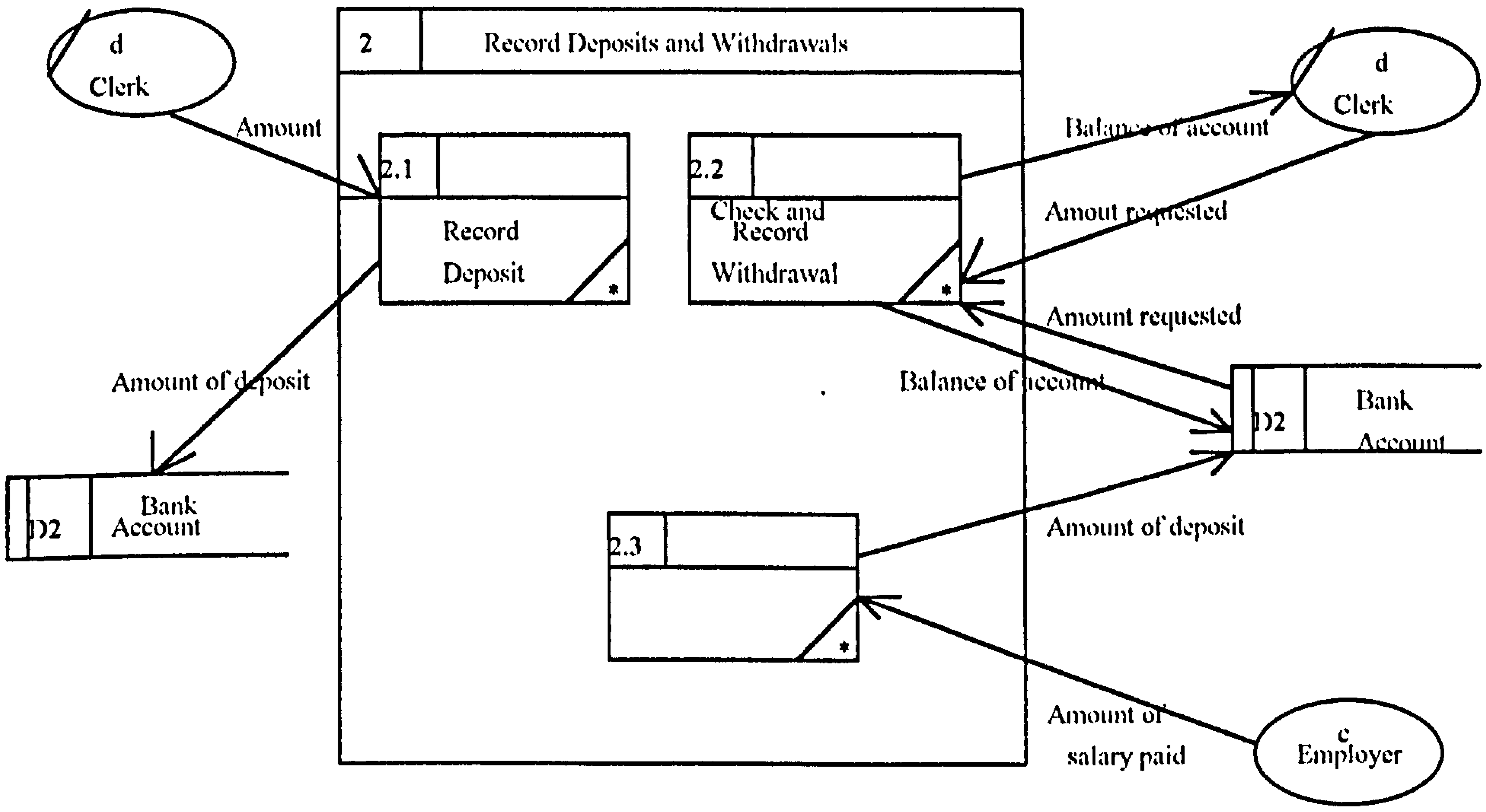

Fig. A 1g Level 2 Data Flow Diagram for Process 2

The second-level Data Flow Diagram of Process 2 is shown in Fig. A 1g. The frame surrounding the lower-level Data Flow Diagram denotes the boundary of the higherlevel process. The identifier of the higher-level process and the naine of the process are put at the top of the frame.

Note that all of the flows to and from the higher-level box have been either duplicated or broken down into several flows at the lower level. If new data flows are identified at the lower level which cross the frame, these should be reflected at the higher level so that consistency between the levels is maintained. To simplify level I diagrams 'to' and 'from' data flows between objects are often combined into one double-headed arrow (see '2-d' on Fig. A 1e). These should always be split into the constituent data flows at the lowest level as with '2.2-d' and 'd-2.2' in Fig. A 1g.

So that it is clearly understood what is represented by each bottom-level process, it is useful to write a brief description of the process with an indication of when the process is triggered into action. This description is called an Elementary Process Description.

External entities are normally described further in External Entity Descriptions. Data flows are further described by Input/Output Descriptions (usually shortened to I/0 Descriptions) which gives the data content (i.e. which attributes it uses) of the flow.

SUMMARY

Data Flow Models are an important systems analysis. technique for representing the flows of information within a system.

The Data Flow Models produced in SSADM are:

* Current Physical;
* Logical;
* Required System.

The components of a Data Flow Diagram are: * external entities;

* processes;
* data flows;
* data stores.

Each process may be further described by:

- Decomposition to another level of Data Flow Diagrams;
- Elementary Process Descriptions.

APPENDIX 4

APPENDIX 4:MODEL SCHEDULING SPECIFICATION*

As a guide to the type of information that should be included in a construction scheduling specification, the following is presented for review, discussion, and future consideration. This model specification is based on a situation in which a single general contractor is responsible for project completion and is contractually required to prepare a CPM schedule that meets the employer's approval.

GENERAL

1. Pursuant to Articles____________________________of the ____________________, the general contractor shall prepare and maintain a detailed progress schedule as described below. This schedule shall be the contractor's working schedule and shall be used to plan, organise, and execute the work, record and report actual performance and progress, and show how the general contractor plans to complete all remaining work as of the end of each progress report period. The schedule shall be in the form of an activity on arrow (I-J format) oriented network diagram (Critical Path Method) and the principles and definition of the terms used herein shall be as set forth in the ____. The ____________________________________ (publication,year). In the event of discrepancies, this section shall govern the development and utilisation of the CPM schedule.

2. A pre-bid conference shall be held at a time, date, and place to be determined later, to review with prospective bidders, how this sec shall be implemented and to answer any questions regarding the scheduling and reporting requirements and the degree of participation, co-operation, and compliance that shall be required of the successful contractor.

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* This specification is adapted with the kind permission of John Wiley & Sons, Reading, USA.

Initial Timetable

Upon receipt of notice to commence work, the general contractor shall promptly prepare a Detailed Project Schedule in the form of a network diagram and shall submit the same for approval by the owner within ______ calendar days after notice to proceed. Limited technical assistance is available to the general contractor from the Supervising Consultant upon written request and prior to any formal review and/or finalization of the initial schedule. Pre-submittal reviews are also available to facilitate co-ordination of the contractor's schedule with other preceding, parallel, and succeeding contracts.

Network Details

1. The Detailed Project Schedule for this contract shall be constructed to show the order in which the general contractor proposes to carry out the work, and to indicate the restrictions of access and availability of work areas and the availability and use of manpower, materials and equipment. The contractor shall utilise the Detailed Project Schedule in planning, scheduling, co-ordinating, and performing the work under this contract (including all activities of subcontractors, equipment vendors, and suppliers). The following criteria shall form the basis for assembly of the logic:

    a. What activity must be completed before a subsequent activity can be started?

    b. What activities can be done concurrently?

    c. What activity must be started immediately following a completed activity?

    d. What major economic facility or manpower restrictions are required for sequencing these activities?

2. The Detailed Project Schedule shall provide sufficient detail and clarity of form and technique so that the contractor can plan, schedule, monitor, control, and report on the progress of his work. In addition, it shall provide the owner with a tool to monitor and

follow the progress for all phases of the work. The Contractor's Programme shall comply with the various limits imposed by the scope of work and by any contractually specified intermediate milestones and completion dates included in the contract. The degree of detail shall be to the satisfaction of the owner, but the following factors shall have a bearing on the required depth of activity detail:

a. The physical and structural breakdown of the project;

b. The contract milestones and completion dates;

c. The type of work to be performed and the labour trades in involved;

d. All purchase, manufacture, and delivery activities for all major materials and equipment;

e. Deliveries of owner-furnished equipment and/or materials;

f. Preparation, submission, and approval of shop and/or working drawings and material samples;

g. Approvals required by regulatory agencies or other third parties;

h. Plans for all subcontract work;

i. Assignment of responsibility for performing specific activities;

j. Access to and availability of work areas;

k. Identification of interfaces and dependencies with preceding, concurrent, and follow-on contractors;

l. Actual tests, submission of test reports, and approval of test results;

m. Planning for phased or total take-over by owner;

n. Identification of any manpower, material or equipment restrictions.

3. The activities included in the Detailed Project Schedule shall be analysed in detail to determine activity time duration in units of project working days. Durations shall be based on the labour (crafts), equipment, and materials required to perform each activity

on a normal work-day basis. Activity durations over 15 working days shall be kept to a minimum except in the case of non construction activities such as procurement of materials, delivery of equipment, and concrete curing. All durations shall be the result of definitive manpower and resource planning by the contractor to perform the work in consideration of contractually defined on-site work conditions. The manpower to be assigned, by craft definition, shall be shown on each construction activity of the network. No more than five (5) crafts may be assigned to a specific activity. If more crafts are required, then the activity in question must be broken down into additional activities.

4. The contractor may use manpower or equipment restraints, separately noted, to optimise and level manpower and equipment requirements. The individual activities involved may be sequenced within the limits of the available total float. However, when this levelling technique is used in establishing the initial schedule, it shall be reflected in the logic with restraints identified as "restraint for manpower or equipment levelling purposes only." Critical or near critical paths resulting from the use of manpower restraints shall be kept to a minimum. Near-critical paths shall be defined as those paths having 14 days or less of total float at the time of initial submission.

5. A unique event numbering system shall be required to code or identify activities by bid items, work items, areas, procurement, etc. No two activities shall have the same two event numbers for identification.

6. The estimated cost to perform each work activity shall be noted graphically on each activity included in the network. The sum of the costs assigned to all activities shall equal the contract value. No activity costs shall be assigned to manufacture or delivery activities.

7. The networks shall be prepared on (___) size sheets and shall have a title block in the lower right-hand corner. Exceptions to the size of the network sheets and the use of computer graphics to generate the networks shall be subject to the approval of the owner.

8. The networks shall clearly indicate all contract milestones and completion dates. All networks shall be drafted to show a continuous flow of information from left to right with no arrows from right to left. The primary path(s) of criticality shall be clearly and graphically identified on the network(s). Each network drawing shall have a standard grid co-ordinate system with alpha designations on the Y-axis (top to bottom) and numerical designations on the X-axis (left to right) for quick activity reference and for following the planned sequence when using multi-sheet networks. Logic ties which cannot be graphically demonstrated as continuous restraints between different segments of the network shall be identified as remote dummies, and shall be referenced as "to/or from event number page number ______," followed by appropriate alpha, numeric grid references, or equivalent designation.

9. As part of each update submission, the status of work in progress shall also be similarly identified and the reported percent complete graphically indicated on each activity remaining in progress as of the last report period.

Use of Computers

1. The mathematical analysis of the Detailed Project Schedule shall be made by computer and a tabulation for each activity shall in include as a minimum the following:

   a. Preceding (i) and following (j) event numbers;

   b. Activity description;

   c. Activity code(s);

d. Schedule and actual/remaining durations for each activity;

e. Earliest start date (by calendar date);

f. Earliest finish date (by calendar date);

g. Actual start date (by calendar date);

h. Actual finish date (by calendar date);

i. Latest start date (by calendar date);

j. Latest finish date (by calendar date);

k. Float in work days;

l. Monetary value of each activity;

m. Percentage of activity completed;

n. Contractor's earnings based on the reported portion of activity completed.

The computer programs used in making the mathematical computation shall be capable of compiling the total value of completed and partially completed activities. The program shall also be capable of accepting revised completion dates as modified by approved time adjustments and re-computation of all activity dates and float accordingly.

2. The following computer outputs shall be required as part of the initial schedule submission and each update thereafter:

a. Activity sort by preceding event number from lowest to highest and then in the order of the following event number;

b. Activity sort by the amount of total float, then in order of preceding event number;

c. Activity sort by early start for the next ____ (___) calendar days, then in order of preceding event number;

d. Activity sort by late finish for the next ____ (__) calendar days, then in order of preceding event number;

e. Activity sort(s) by organisational responsibility. Outputs (a) and (b) above shall show all activities, including re restraints for the duration of the project.

Master Summary Schedule

The contractor shall also prepare and submit a time-scaled Master Summary Schedule on a single sheet that shows the total project in approximately ____ to _____ activities. This schedule will accurately summa the computerised Detailed Project Schedule and shall have common events for correlating the two levels of schedule indenture. Emphasis shall be placed on major milestones and key dependencies among the various parties involved. The Master Summary Schedule shall be up dated monthly.

Cash Flow Projection

Using the cost assigned to each activity of the Detailed Project Schedule, the contractor shall develop a cash flow analysis illustrated by a computer listing and a graphic display, both of which shall depict the estimated cash draw down in the aggregate, by month, over the life of the project. The cash flow projection shall be updated each month to show actual cash draw down based on certified interim payments and a forecast of remaining payments to be made over the remaining life of the project.

Manpower Requirements Forecast

The contractor shall prepare a manpower analysis in the form of a series of graphic displays depicting manpower by principal trades in the aggregate, and in accordance with the Detailed Project Schedule. The graphs shall display the number of man-days of effort, for each month, over the life of the project. This submission may be computerised or manually prepared, but shall be correlated with the manpower assigned to each activity of the Detailed Project Schedule. The Manpower Requirements Forecast shall be updated monthly and shall include the manpower actually used by trade as of the current report period and the manpower required to complete all remaining contract work.

Submission of Programme Documentation

1. The Contractor's Programme (logic diagrams and computer tabulations), the Master Summary Schedule, the Cash Flow Projection, and the Manpower Requirements Forecast shall be submitted to the owner for approval within thirty (30) calendar days after notice to proceed in the following quantities:

a. Detailed and Summary Schedules (reproducible and _____ sets of prints);

b. Computer tabulations (_____ copies 8 1/2"x 1 1 " in size);

c. Manpower Requirements Forecast (___copies 8 1/2"x 1 1 " in size);

d. Cash Flow Projections (_____ copies 8 1/2"X 1 1 " in size).

2. In addition to the above, the contractor shall provide a copy of its computer file in the form of a hard or floppy disk. The disk shall include the information contained in the schedule submittal. If additional submittals are necessary, a disk for each submittal shall be provided by the contractor.

Approval Process

1. The owner shall approve or disapprove, in writing, the contractor's submission within __________ (____) calendar days after receipt of all re required information.

2. If the contractor fails to submit the initial Detailed Project Schedule, Master Summary Schedule, manpower Requirements Forecast, Cash Flow Projection, or the computer disk within the time prescribed, or revisions thereof within the requested time, the owner may withhold approval of progress payment estimates until such time as the contractor submits the required information.

3. At the request of the owner or his authorised representative, the contractor shall be required to participate in any meetings necessary to reach a mutual agreement and approval of the initial Detailed Project Schedule, Master Summary Schedule, Manpower Requirements Forecast, Cash Flow Projections, or the computer disk.

4. If any of the required submissions are returned to the contractor for corrections or revisions, they shall be resubmitted along with a new computer disk for approval within ________ (____) calendar days after the return mailing date. Re submissions shall be in the same quantities as noted above. Review and response by the owner shall be given within _______ (___) calendar days after receipt of each new submission.

Updating the Programme

The initial updating shall take place during the first week after the approval of the contractor's schedule. Subsequent updates shall be scheduled at the end of each month thereafter for the duration of the contract. The Contractor's Programme and computer tabulations shall be reviewed jointly at a meeting with the owner's authorised representative for the purpose of verifying:

a. Actual start dates;

b. Actual completion dates;

c. Cost value of work reported in Place:

d. Activity percent completion;

e. Revised logic (as-built and projected) and changes in activity durations, cost, and manpower assigned;

f. Influence of variations;

g. Revisions due to unauthorised modifications;

h. Incorporation of approved time extensions. The owner shall inform the contractor of the date, time, and place of each updating.

2. The contractor shall come to the updating meetings with the above data prepared in advance for each meeting to provide, as of the end of the updating period, a complete and accurate report of current procurement and construction progress and a depiction of how the contractor plans to continue the work of this project to meet all contract completion dates. All network changes and status data agreed to during each update shall be considered as acceptable by both parties unless written notice of any exceptions is given by an objecting party within ten (10) calendar days after receipt of the contractor's update submission. For major network changes that cannot be agreed to during an updating meeting, the contractor shall submit, in writing, such revisions for the owner's approval prior to inserting such changes into the network. Submissions may be in the form of marked-up networks, fragnets, or schedule abstracts, provided they are submitted with a letter of transmittal. The submission and approval procedures for this information shall follow low the same timetable described for Variations, Delays, and Time Extensions noted below.

3. As part of the monthly updating process, the contractor shall prepare a Narrative Progress Report describing the physical progress during the report period, plans for continuing the work during the forthcoming report period, actions planned to correct any negative float predictions, and an explanation of potential delays and/or problems and their estimated impact on performance and the over all project completion date. In addition, alternatives for possible schedule recovery to mitigate any potential delay and/or cost in creases should be included for consideration by the owner.

4. _______ copies each of the Narrative Progress Report, the updated Detailed Project Schedule (networks, and computer computations), the Summary Master Schedule, the Cash Flow Projection, the Manpower Requirements Forecast, and an updated computer disk shall be submitted to the owner within five (5) calendar days after each updating meeting.

5. If the contractor fails to timely submit any of the update deliver, the owner may withhold approval of progress payment estimates mates until such time as the contractor submits the required update reports.

Variations, Delays, and Time Extensions

1. When variations or delays are experienced by the contractor and the contractor requests an extension of time, the contractor shall submit to the owner a written Time Impact Analysis illustrating the influence of each change or delay on the current contract schedule completion date. Each Time Impact Analysis shall include a fragnet demonstrating how the contractor proposes to incorporate the variation or delay into the Detailed Project Schedule. A fragnet is defined as a sequence of new activities and/or activity revisions that are proposed to be added to the existing schedule to demonstrate the influence of delay and the method for incorporate delays and impacts into the schedule as they are encountered.

2. Each analysis shall demonstrate the estimated time impact based on the events of delay, the date the change was given to the contractor, the status of construction at that point in time, and the event time computation of all activities effected by the variation or delay. The event times used in the analysis shall be those included in the latest update of the Contractor's Programme or as adjusted for the events of delay.

3. Time extensions will be granted only to the extent that equitable time adjustments for the activity or activities affected exceed the total or remaining float along the path of activities at the time of actual delay or at the time notice to proceed was issued for a change. Each Time Impact Analysis shall be submitted in triplicate and within fifteen (15) calendar days after a delay occurs or notice of direction for proceeding with a variation is given to the contractor. In cases where the contractor does not submit a Time Impact pact Analysis for a specific variation or delay within the specified period of time, it shall be deemed to have irrevocably waived its rights to any additional time and cost.

4. Approval or rejection of each Time Impact Analysis by the owner shall be made within fifteen (15) calendar days after receipt of each Time Impact Analysis, unless subsequent meetings and negotiations are necessary. Upon approval, a copy of a Time Impact Analysis signed by the owner or its authorised representative shall be returned to the contractor for incorporation into the schedule. Upon mutual agreement by both parties, fragnets illustrating the influence of variations and delays shall be incorporated into the Detailed Project Schedule during the first update after agree is reached. In the event the contractor does not agree with the decision of the owner regarding the impact of a change or delay, it shall be resolved in accordance with the disputes clause of the contract.

Appendix 5

CONFIRMATION OF RECEIPT OF INSTRUCTION

TO THE ENGINEER

Our Ref:

Date:

No:

Dear Sir

CONTRACT ______________________________

We confirm the following oral/written instructions given to our representative ______________________

on site by ______________________ on ______________ 19 ______

If any of the above should be a variation of the Works and/or involve extra costs, loss or expense, we give notice of claim for reimbursement under the appropriate condition of the Contract.

Copy to: **WHITE – ENGINEER**
BLUE – QS
PINK – AGENT
YELLOW – DAYFILE/MASTERFILE REF No 3.1.4.

Yours faithfully

TEXT BOUND INTO

THE SPINE

OREMAN'S OR GANGER'S AILY RETURN

Contract ____

Nr. C ____

eman or Ganger D. T. Mitchell

Day	Date	Month	Year
Thur	3	October	1994

Name	Trade	Time Started	1	2	3	4	5	6	7	8	9	10	Time Finished	Total Hours
D T Mitchell.	GANG	07.30									6	3.	17.00	9.
A Coppell.	LAB	08.00				8½							"	8½
M. Symons.	Floorer	07.30						8	1.				"	9
G. Howells.	"	"		9									"	9
D. Howells.	C/Bay	08.00					8½						"	8½
T Porter.	Carp	"				8							6.30	8
R. Broadway.	"	"			8								"	8
B. Porter	Fixer/form	"						8					"	8
K. Mitchell	GW	07.30	9.										17.00	9.
L. Davey.	Fix	08.00						8					16.30	8
A Good.	P/L.	"											17.00	
J. Martin	GW.	"											"	
M. Cooper.	"	"								2		3.	"	
S Way	"	"											"	
M Farr	"	"											"	
B Jones.	"	"								8½			"	8½
C. James.	"												"	

Operation Nr.	Description of Operations
1	Batch Comps for bricklayers
2	Drive Forklift.
3	Tiling + Fixing cills.
4	Patching in house's.
5	Setting out with Eng
6	Snagging internals + Externals
7	opening + closing Doors to house's.
8	Cut Down plastic M/H's + Clean up around site
9	order Materials + Supervise Men.
10	lay Slabs for Footpath Plot 49.

Operation Nr.	Plant Used Type	No.	Working Hrs. THC(R)	Working Hrs. Hired
17, 19	JCB (DNS)	1		✓
18	JCB (GD)	1		✓
2	JCB. TS Forklift.	1		✓
16, 19	4 Ton Dumpers	1		✓

Working Hrs. ____

Verified ____

Agent/ ____

Gen. Foreman ____

Time ____

CONFIRMATION OF VERBAL INSTRUCTION

Our Ref:

Date:

No:

Dear Sir

CONTRACT____

We confirm the following oral/written instructions given to our representative

on site by___________________________ on________________ 19____

Copy to: ENGINEER (If applicable)
QUANTITY SURVEYOR
SITE SURVEYOR
CLERK OF WORKS
SITE
CENTRAL FILE

Yours faithfully

S8421

ontract No. ....

ontract Address ....

....

....

....

Date ______________________________

Our Order No. ______________________________

Instruction Record No. ______________________

Instruction to Sub-Contractor

u are instructed in accordance with the terms of the above Order and by the conditions of the main contract as follows:-

ork to commence by:- .... Work to be completed by:- ....

his instruction does not necessarily constitute a variation to the contract..

the time for completion is affected by this instruction and is not specified above the sub-contractor should indicate accordingly to the Main Contractor ithin 10 days.

here a variation in price is required and not specified above the details should be forwarded to the Main Contractor within 14 days.

____
oject Manager / Agent

Copies		Sub-Contractors
Area Office		
Site		

S8434

REQUEST FOR INFORMATION/TECHNICAL QUERY

To: Architect/S.O./Engineer

No. ______________________

Contract No.______________ Date______________

Contract__________________________________

____

Please reply to: Site Area Office

QUERY – By the Contractor. We require details/instructions regarding the following:

The above details/instructions are

required by ______________________

Signed:
by the Contractor ______________________

REPLY – By Architect/S.O./Engineer* Note: This reply constitutes an instruction/direction to proceed under the terms of the Contract.

SIGNED: ARCHITECT/S.O./ENGINEER*______________________ DATE ______________

* or their appointed representatives. Name______________________ Designation:______________

NOTE: TO BE SUBMITTED IN DUPLICATE, TOP COPY TO BE RETURNED WITH REPLY

CIRCULATION ORDER:	White	–	Architect/Engineer (To be returned to contractor)	Blue	–	Site
	Pink	–	Architect/Engineer (To be retained)	Yellow	–	Area Office

S8428

OPERATIVES TIME SHEET

CONTRACT No. .... CONTRACT NAME.. WEEK ENDING.......................

CLOCK No.	NAME	TRADE	T = TRANSFER S = SICKNESS H = HOLIDAYS A = ABSENT							TOTAL ACTUAL HOURS	TOTAL WITH PREMIUM TIME	BONUS PER WEEK * PER HOUR	TRAVEL ALLOWANCE	TOOL/ CONDITION MONEY	OTHER PAYMENT PLEASE SPECIFY
			ACTUAL DAILY HOURS WORKED												
			M	T	W	T	F	S	S						

LABOUR & PLANT ALLOCATION

Contract No.

C/Hand Signature

Date Trade

Agent/GF Signature

CHECK No.	OPERATIVES NAME	TRADE	TOTAL HRS.	DESCRIPTION OF WORK DONE						
	PLANT USED									

SAMPLE

Appendix 5 Sample Records

Operation Code No	Description	Cost: Labour&Plant	Materials	Subcontract	Total Cost	Allowance	Adjustments	Adj.Allow.		Result	Percent	Operation Code No
01	Demolition & Alteration	0	0	0	0	0	0	0	+	0	+***.**	01
02	Earthworks	483	0	0	483	478	-7	471	-	12	- 2.55	02
03	Hardcore&Filing/Sub-bse	1370	475	0	1845	1729	-24	1705	-	140	- 8.21	03
04	General Piling	475	824	1118	2417	1920	-27	1893	-	524	- 27.68	04
05	Other Geotech.Services	0	0	154	154	0	0	0	-	154	+***.**	05
06	Concrete	0	0	0	0	0	0	0	+	0	+***.**	06
07	Reinforcement	0	0	40	40	0	0	0	-	40	+***.**	07
08	Formwork	0	0	0	0	0	0	0	+	0	+***.**	08
09	Stc.Precast/Stress.Conc	3716	1935	0	5651	3913	-55	3858	-	1793	- 46.47	09
10	Asphalt Work	0	0	2555	2555	3067	-42	3025	+	470	+ 15.54	10
11	Brickwrk/Blockwrk/Msnry	0	-9000	0	-9000	400	-8828	-8428	+	572	- 6.79	11
12	Cladding	0	0	0	0	0	0	0	+	0	+***.**	12
13	Roofing	0	0	1845	1845	1953	-27	1926	+	81	+ 4.21	13
14	Carpentry/Ironmongery	0	8233	4451	12684	6119	1914	8033	-	4651	- 57.90	14
15	Structural Steel	576	0	0	576	577	-8	569	-	7	- 1.23	15
16	Metalwork	313	142	0	455	700	-9	691	+	236	+ 34.15	16
17	Plumbing&Mechanical Eng	0	0	8886	8886	7695	-107	7588	-	1298	- 17.11	17
18	Electrical Installation	0	0	3616	3616	2619	-36	2583	-	1033	- 39.99	18
19	Plastering/Screeds	253	0	706	959	603	-8	595	-	364	- 61.18	19
20	Tiling	0	0	260	260	0	0	0	-	260	+***.**	20
21	Suspended Ceilings	671	582	0	1253	-1475	21	-1454	-	2707	+186.18	21
22	Floor Finishings	0	0	1025	1025	0	-1	-1	-	1026	+***.**	22
23	Glazing/Curtain Walling	0	0	0	0	0	0	0	+	0	+***.**	23
24	Painting & Decorating	0	0	1157	1157	960	-13	947	-	210	- 22.18	24
25	Drainage	2472	1601	750	4823	4263	-60	4203	-	620	- 14.75	25
26	Kerbing & Edging	210	416	1	627	-61	-999	-1060	-	1687	+159.15	26
27	Ext.Pavings-Bituminous	1539	0	3903	5442	4835	-67	4768	-	674	- 14.14	27
28	Ext.Pavings-Not Bitum.	6	1743	0	1749	1319	-1019	300	-	1449	-483.00	28
29	Fencing	0	0	1118	1118	4529	-1562	2967	+	1849	+ 62.32	29
30	Landscaping	657	920	1664	3241	3117	-43	3074	-	167	- 5.43	30
80	Site Staff	319	4957	0	5276	5764	-81	5683	+	407	+ 7.16	80
81	General Attendance Lab.	4257	0	1824	6081	3630	-50	3580	-	2501	- 69.86	81
82	Site Offices	360	0	0	360	657	-9	648	+	288	+ 44.44	82
83	Site Services	0	0	500	500	521	-7	514	+	14	+ 2.72	83
84	Site Transport	1854	0	-500	1354	757	-11	746	-	608	- 81.50	84
85	Office Exp./Petty Cash	0	147	0	147	230	-3	227	+	80	+ 35.24	85
86	Small Tools/Tackle	590	272	0	862	156	-2	154	-	708	-459.74	86
87	Survey/Lab&Comms Equip.	230	0	0	230	70	-1	69	-	161	-233.33	87
88	Insurance,Bonds,Rates	1113	0	-1335	-222	279	-4	275	+	497	+180.73	88
89	Spare	3377	0	0	3377	589	3992	4581	+	1204	+ 26.28	89
90	Scaffold & Gantries	0	0	0	0	0	0	0	+	0	+***.**	90
91	Gen.Plant,Lab,Mats,Suby	5641	0	0	5641	881	-12	869	-	4772	-549.14	91
92	Tran.,Plant on/off Site	0	0	0	0	0	0	0	+	0	+***.**	92
93	Temp.Works-General	69	0	499	568	154	-2	152	-	416	-273.68	93
94	Temp.Works-Structural	0	0	0	0	0	0	0	+	0	+***.**	94
95	Nom.Subcontractors Att.	0	-583	672	89	442	-6	436	+	347	+ 79.59	95
	Nett Totals	30551	12664	34909	78124	63390	-7203	56187	-	21937	- 39.04%	
	Average Overheads 0.00%	0	0	0	0	0	0	0	+	0		
	Average Profit 2.00%					1267	-144	1123		1123		

	DAILY RECORD	R.E.INST.No.		DATE	

DESCRIPTION OF WORKS	NAME	TRADE AND FUNCTION	NO.	USE 24-HR CLOCK ON	USE 24-HR CLOCK OFF	ALLOCATION NO.	
						DETAILS OF WORK	

MATERIALS DESCRIPTION	QUANT	UNIT
SAMPLE		

PLANT	DESCRIPTION	RATING	NO.	On	OFF
NOTE: H.P. or bucket size in Rating column, vehicle number in No. column.					

Distribution:—
Top White — Resident Engineer
2nd Pink — Site Q.S.
3rd Yellow — Site Engineer

S8341

CONTRACTORS SIGNATURE		SIGNATURE FOR DAILY RECORD		FOR		DATE	

REQUEST FOR APPROVAL

To: Architect/S.O./Engineer

No. ____________________

Contract No.______________ Date____________

Contract______________________________

____

REQUEST – By the Contractor. We request your approval to the following proposals:

Your reply is requested by ______________________

Signed:
by the Contractor ______________________

REPLY – By Architect/S.O./Engineer* Note: This reply constitutes an approval to proceed under the terms of the Contract.

SIGNED: ARCHITECT/S.O./ENGINEER*______________________ DATE ______________

* or their appointed representatives. Name______________________ Designation:______________

NOTE: TO BE SUBMITTED IN DUPLICATE, TOP COPY TO BE RETURNED WITH REPLY

CIRCULATION ORDER: White – Architect/Engineer (To be returned to contractor) Blue – Site
Pink – Architect/Engineer (To be retained) Yellow – Contract Manager

S8427

Appendix 6

Appendix 6 Sample Calculation of Head Office Overheads & Profitss

Plascrug - Outstanding Info for Steve McC.

1. Overheads, Profit.

From area Trading Results:
to end May 92 (ie Oct/May = 8mths)

T/O	£ 21 124
O/h	
area	592
centre	170
Divn	46
	808

$\therefore$ O/h = 808/21124 = 3.83%

From Region Trading Results. (8mth period)

T/O	£ 40 634
O/h	
region	1 425
Mitcham	445
Divn	174
	2 044

$\therefore$ O/h = 2044/40634 = 5.03%

Overheads (off site)		5.03
Profit	say	5.00
"Better buying" loss		2.50
		12.53%

Appendix 6 Sample Calculation of Head Office Overheads & Profitss

	Direct	Indirect
Mmt Work	278.2	
S. Tools		2.8
Prelims		169.5
O/H		9.0
S/C's	439.5	
O/H		8.2
NSC	356.6	
O/H		2.1
Nom Supp	13.0	
O/H		0.3
Prov Sums	108.7	
D/W	4.8	
Ins		2.1
Sund		.7
adjmts	(93.7)	(33.2)
	1107.1	167.5

Total O/H $167.5 / 1107.1 = 15.13\%$

Appendix 7

Appendix 7: Definition of Concepts

Project

A unique set of co-ordinated activities, with definite starting and finishing points undertaken to meet specific objectives, with defined schedules, cost and performance targets.

Claims

Demands for reimbursement under provisions entitling the contractor to compensation for the client or his agents default.

Claims documentation

Written statement produced by the contractor setting out the basis of claims with supporting evidence.

Claims management

The process of collating project information to comply with stipulations of contract and to produce a claims documentation, capable of being used in the ascertainment and settlement of claims with the effective use of available resources within reasonable time.

Project management

Planning, monitoring and control of all aspects of a project and the motivation of all those involved in it to achieve project objectives on time and to a specified cost, quality and performance.

Claim type

Refers to the kind of claim being made. For example, whether it is a time extension or loss and expense claim.

Heads of claim

Items of cost included under each claim type. For example, a typical claim would include cost of plant, labour, material and management cost.

Contract Administrator

Refer to the Architect or Engineers supervising the project on behalf of the employer.

Fragnets

A sequence of new activities and/or activity revisions that are proposed to be added to an existing schedule to demonstrate the influence of delay and method for incorporating delays and impacts into a schedule as they are encountered.

Appendix 8

Appendix 8-Sample Calculation of Head Office Overheads and Profits

		£' 000
Turnover		4,200.00
Cost of sales		2,300.00
Gross Profit		1,900.00
Distribution costs	945.00	
Adminstrative expenses	563.00	
		1,508.00
Operating profit		392.00
exceptional items		50.00
Profit before Interest		342.00
Interest Payable		50.00
Profit before ordinary activities before taxation		292.00
Taxation		102.00
Profit of the Year		190.00
Dividends		60.00
Retained Profit for the Year		130.00

A common format for a typical profit and loss account which complies with the Companies act is shown above. From these figures the percentage(%) to be applied for head office overheads in a claim for any additional expenditure can be obtained by dividing the administrative cost by annual turnover:

% Overhead = {563000/4200,000}* 100

% Overhead = 13.4 %

While the % to be applied for profit can estimated as:

% Profit = (190/4200) * 100

% Profit = 4.5%

Appendix 9

UNIVERSITY OF WOLVERHAMPTON
SCHOOL OF CONSTRUCTION ENGINEERING & TECHNOLOGY

Time and Cost of Evaluating Contractors' Claims - Research Questionnaire(A)

SECTION A: GENERAL INFORMATION

Name of Respondent(optional): RJW REYNOLDS.

Position in Organisation: COMMERCIAL DIRECTOR

Name of Organisation: FITZPATRICK CONTRACTORS

A1. Please tick to indicate the nature of your organisations activities.

Building Contracting [ ]

Civil Engineering Contracting [ ]

Building and Civil Engineering Contracting [✓]

A.2. What is the approximate turnover of your organisation per annum?(Please tick)

Less than £5m [ ]

£5m - £10m [ ]

£10m - £25m [ ]

£25m - £50m [ ]

£50m - £100m [✓]

Over £100m [ ]

SECTION B: CLAIMS PREPARATION

B1. Who is normally responsible for preparing contract documents(Please tick) ?

1 Project Manager [ ] JOINTLY.

2 Contracts Manager [✓]

3 Senior Quantity Surveyor [✓]

4 Internal Legal Advisor [ ]

5 Purchasing Manager [✓]

Others(Please specify below) [ ]

B2. Indicate the extent to which the following are involved in the preparation of claims arising out of contracts undertaken by your organisation. Use a scale of 0 - 10, where 0 = never involved to 10 = always involved.

Project Manager [10]

Project Quantity Surveyor [10]

Head Office-based QS [8]

Site Planning Manager/Agent [7]

Claims Surveyor [-]

External Claims Consultants [7]

Others(Please specify below) [ ]

Comment:

B3. Please indicate your orientation to claims. Use a scale of 0 - 10 where, 0 = we never submit claims to 10 = pursue claims with all effort.

[5]

B4. Please rate the following aspects of claims preparation in terms of the time involved. Use a scale of 0 - 10 where, 0 = very low to 10 = very high.

identifying relevant information	[6]
identifying sources of information	[6]
retrieving relevant information	[8]
archiving project information	[6]
interpretation of contracts and justifying claims	[8]
response to architect/engineer's requests for information	[8]
quantifying claims	[7]
preparing claims document for presentation	[7]
others(please specify)	[ ]

____

Comment:_______________________________

B5. Please rate the following aspects of claims preparation in terms of the cost involved. Use a scale of 0 - 10 where, 0 = very low to 10 = very high.

identifying relevant information	[ ]
identifying sources of information	[ ]
retrieving relevant information	[ ]
archiving project information	[ ] as prev.
interpretation of contracts and justifying claims	[ ]
response to architect/engineer's requests for information	[ ]
quantifying claims	[ ]
preparing claims document for presentation	[ ]
others(please specify)	[ ]

____

Comment:____

B6. Comment on the most serious causes of delay in the preparation of claims.

LACK OF RESOURCE

B7. Please indicate the extent to which the following items of claim are subject to dispute in practice. Use a scale of 0 - 10, where 0 = not likely to 10 = most likely.

on-site overheads	[4]
head office overheads	[7]
loss of profit	[8]
inflation of costs	[3]
interest and finance charges	[9]
cost of disruption	[8]
cost of preparing claims	[10]
others(please specify)	[ ]

____

Comment:____

____

B8. Indicate the extent to which the following aspects of site overheads are subject to dispute in practice. Use a scale of 0 - 10, where 0 = never disputed to 10 = always disputed.

unit costs of plant	[3]
unit costs of materials	[2]
unit costs of labour	[7]
cost of supervisory and management staff	[5]
availability of contractors' build-up of preliminaries	[1]
others(please specify)	[ ]

____

Comment:____

____

B9. Indicate the extent to which the following aspects of head office overheads are subject to disputes in practice. Use a scale of 0 - 10, where 0 = never disputed to 10 = always disputed.

claimed percentage for general head office overheads [7]

inadequate records of direct head office involvement [5]

recoverability in principle [5]

use of Hudson's formula [7]

use of Emden's formula [7]

use of general formulae [7]

others(please specify) [ ]

____

Comment: ____

B10. Indicate the extent to which the following aspects of loss of profit are subject to disputes in practice. Use a scale of 0 - 10, where 0 = never disputed to 10 = always disputed.

inability to demonstrate alternative profit making opportunities [9]

lack of evidence of profitability on current projects [4]

others(please specify) [ ]

____

Comment:

B11. Indicate the extent to which aspects of inflation component of claims are disputed on the following grounds. Use a scale of 0 - 10, where 0 = not likely to 10 = most likely.

lack of evidence of extra costs beyond fluctuation allowance [6]

recoverability in principle [1]

others(please specify) [ ]

____

Comment: _______________

____

B12. Indicate the extent to which reduced productivity component of claims are disputed on the following grounds. Use a scale of 0 - 10, where 0 = never disputed to 10 = always disputed.

lack of plant and labour records [2]

inappropriate allocation of responsibility [4]

application of general formulae [5]

application of general percentages [5]

others(please specify) [ ]

____

Comment: _______________

____

____

____

B13. Please indicate the extent to which the following are used in claims documents you submit. Use a scale 0 - 10, 0 = never used to 10 = always used.

revised drawings	[8]
level records	[5]
site diaries	[6]
site photographs	[8]
schedules	[7]
minutes of site meetings	[7]
claim documentation(including notification)	[10]
Bills of Quantities	[7]
analysis of tender	[4]
specification	[7]
records of delay and disturbance	[6]
day works records	[6]
time sheets	[7]
correspondence	[10]
conditions of contract	[10]
programme analysis	[8]
others (please specify)	[ ]

____

Comment:____

B14. Indicate (by ticking) the circumstances under which you would use external claims consultants.

for all claims [~~✓~~]

when the value of claim is high [ ]

at arbitration hearings [ ]

when a claim is initially rejected [ ]

others(please specify) [✓]

____

Comment: LACK OF INTERNAL RESOURCE.

B15. Make general comments on aspects of claims evaluation that take most of your time in the justification, preparation, presentation of claims.

B16. Would you be prepared to grant us an interview to further solicit your opinion on the management issues raised by claims generally ?

YES [✓]

NO [ ]

Thank you very much for your time.

Please forward the completed questionnaire to the address below in the enclosed envelope.

W. Vidogah
MA266
School of Construction Engineering & Technology
University of Wolverhampton
Wulfruna Street
WV1 1SB

UNIVERSITY OF
WOLVERHAMPTON
SCHOOL OF CONSTRUCTION ENGINEERING & TECHNOLOGY

Time and Cost of Evaluating Contractors' Claims - Research Questionnaire (B)

SECTION A: GENERAL INFORMATION

Name of Respondent(optional): ______________________________

Position in Organisation: ______________________________

Name of Organisation: ______________________________

A1. Please tick to indicate the nature of your organisations activities

Firm of Architects	[ ]
Firm of Engineers	[ ]
Firm of Quantity Surveyors	[✓]
Local Authority	[ ]

Please turnover

SECTION B: CLAIMS EVALUATION

B2. Please indicate the level of involvement of the following in the detailed evaluation of claims arising out of contracts administered by your organisation. Use a scale of 0 - 10, where 0 = no involvement to 10 = total involvement.

Project Architect/Engineer	[2]
Project Quantity Surveyor	[10]
Project Manager	[2]
Client	[0]
Others(Please specify below)	[ ]

____

Comment on the role of the above in claims evaluation:

____

____

B2. Indicate how frequently the following have been grounds on which you have rejected contractor's claims in practice. Use a scale of 0 - 10, where 0 = not frequent to 10 = very frequent.

non-entitlement in principle	[3]
non-compliance with contractual procedures	[2]
inadequate information	[7]
lack of breakdown of claim by causes	[6]
inadequate effort at mitigation	[1]
validity of architect/engineer's instructions	[0]
quantification of claim	[10]
others(please specify)	[ ]

____

B3. Please indicate the extent to which the following items of claim are subject to dispute in practice. Use a scale of 0 - 10, where 0 = not likely to 10 = most likely.

on-site overheads	[3]
head office overheads	[10]
loss of profit	[10]
inflation of costs	[5]
interest and finance charges	[2]
cost of disruption	[8]
cost of preparing claims	[1]
others(please specify)	[ ]

Comment:

B4. Indicate the extent to which the following aspects of site overheads are subject to dispute in practice. Use a scale of 0 - 10, where 0 = never disputed to 10 = always disputed.

unit costs of plant	[7]
unit costs of materials	[3]
unit costs of labour	[3]
cost of supervisory and management staff	[7]
availability of contractors' build-up of preliminaries	[1]
other (please specify)	[ ]

Comment:

B5. Indicate the extent to which the following aspects of head office overheads are subject to disputes in practice. Use a scale of 0 - 10, where 0 = never disputed to 10 = always disputed.

claimed percentage for general head office overheads	[10]
inadequate records of direct head office involvement	[10]
recoverability in principle	[9]
use of Hudson's formula	[0]
use of Emden's formula	[0]
use of general formulae	[5]
others(please specify)	[ ]

____

Comment: ______________________________

____

B6. Indicate the extent to which the following aspects of loss of profit are subject to disputes in practice. Use a scale of 0 - 10, where 0 = never disputed to 10 = always disputed.

inability to demonstrate alternative profit making opportunities	[2]
lack of evidence of profitability on current projects	[2]
others(please specify)	[ ]

____

Comment: ______________________________

____

____

B7. Indicate the extent to which aspects of inflation component of claims are disputed on the following grounds. Use a scale of 0 - 10, where 0 = not likely to 10 = most likely.

lack of evidence of extra costs beyond fluctuation allowance [3]

recoverability in principle [2]

others(please specify) [ ]

____

Comment: ______________________

____

B8. Indicate the extent to which reduced productivity component of claims are disputed on the following grounds. Use a scale of 0 - 10, where 0 = never disputed to 10 = always disputed.

lack of plant and labour records [2]

inappropriate allocation of responsibility [—]

application of general formulae [—]

application of general percentages [—]

others(please specify) [ ]

____

Comment: ______________________

____

____

____

____

B9. Please indicate the extent to which the following are generally lacking in claims submitted by contractors. Use a scale 0 - 10, 0 = never lacking to 10 = always lacking.

revised drawings	[–]
level records	[2]
site diaries	[1]
site photographs	[1]
schedules	[–]
minutes of site meetings	[–]
claim documentation(including notification)	[3]
Bills of Quantities	[–]
analysis of tender	[–]
specification	[–]
records of delay and disturbance	[5]
day works records	[1]
time sheets	[1]
correspondence	[–]
conditions of contract	[–]
others(please specify)	[ ]

Comment:

B10. Please make relevant comments on the aspects of the claims evaluation process that takes up most of your time and effort.

TRYING TO GET CONTRACTOR TO AGREE WITH PRINCIPLES DIFFERENT TO THOSE HE USED WHICH HE THINKS MUST BE CORRECT!

B11. Would you be prepared to grant us an interview to further solicit your opinion on the management issues raised by claims generally ?

YES [ ]

NO [✓]

Thank you very much for your time.

Please forward the completed questionnaire to the address below in the enclosed envelope.

W. Vidogah
MA266
School of Construction Engineering & Technology
University of Wolverhampton
Wulfruna Street
WV1 1SB

Appendix 10

```
* RULE LIST                    Page:   1
* ---------
[ 1]          CRYSTAL  MASTER  RULE
    F IF       DO: View Form
              [time$(now())]

                    CLAIMS        MANAGEMENT        SYSTEM
                    @ W. VIDOGAH  (SCET) UNIVERSITY OF WOLVERHAMPTON

              @CMS
              *
* RULE LIST                    Page:   2
* ---------
                               time$(now())

      AND      DO: Test Expression
              keywait(3)
    F  AND      DO: Menu Question  option

                         CLAIMS MANAGEMENT SYSTEM
                         ------------------------

                         1.{Claims Advisor}

                         2.{Scheduling Advisor}

                         3.{Claims Quantification Advisor }

                         4.{Documentation Assistant}

                         5.{Help}

                    Select one option and press the ENTER key or ESC to exit

              @CMS
              Blue on Gray          Lt_Red on Blue

      AND      DO: Fail

    F OR       DO: View Form
              [date$(now()) ]       [time$(now()]          [day$(now()) ]
**
* RULE LIST                    Page:   3
* ---------


                    A KNOWLEDGE-BASED SYSTEM FOR THE EVALUATION OF CLAIMS IN
                                   CONSTRUCTION

                              WILLIAM VIDOGAH
                    @ School Of Construction Engineering  And Technology
                         University Of Wolverhampton

*
* RULE LIST                    Page:   4
* ---------
              OUT : 0,0,15
                 date$(now())
              OUT : 0,31,43
                 time$(now())
              OUT : 0,66,79
                 day$(now())

      AND      DO: Test Expression
              keywait(3)
      AND      DO: Test Expression
              option=1
      AND      DO: Test Expression
```

```
            load("cms1.kb")

    F OR        DO: View Form
            |date$(now()) |       |time$(now()) |          |day$(now()) |


                       THE SCHEDULLING ADVISOR

                          WILLIAM VIDOGAH
                  @ School Of Construction Engineering  And Technology
                       University Of Wolverhampton

*
* RULE LIST                 Page:   5
* ---------
                       COL : 17,69    White on Blue      COL : 18,10    Lt_Green on Blue
                          date$(now())
           OUT : 0,28,42
              time$(now())
           OUT : 0,66,79
              day$(now())

      AND      DO: Test Expression
            keywait(3)
      AND      DO: Test Expression
            option=2
    W  AND      DO: Display Form
           WPOS: 12,20,1,37
            Scheduling Advisor is not installed
           COL : SURR      White on Blue
           COL : 0,0      White on Blue

      AND      DO: Quit

     OR       DO: Test Expression
            keywait(5)
    F  AND      DO: View Form
            |date$(now()) |       |time$(now())     |       |day$(now()) |

                      THE CLAIMS QUANTIFICATION ADVISOR

                  A KNOWLEDGE-BASED SYSTEM FOR THE EVALUATION OF CLAIMS IN
                          CONSTRUCTION

                          WILLIAM VIDOGAH
                  © School Of Construction Engineering  And Technology
*
*
* RULE LIST                 Page:   6
* ---------
                       University Of Wolverhampton
                          date$(now())
           OUT : 0,30,51
              time$(now())
           OUT : 0,66,79
              day$(now())

      AND      DO: Test Expression
            option=3
      AND      DO: Test Expression
            load("cms2.kb")

     OR       DO: Test Expression
            keywait(5)
      AND      DO: Test Expression
            option=4
    W  AND      DO: Display Form
*
* RULE LIST                 Page:   7
```

```
* ---------
            WPOS: 9,21,1,36
             Documentation Advisor not installed
            COL : SURR      White on Blue
            COL : 0,0       White on Blue

      AND      DO: Quit

     OR        DO: Test Expression
            keywait(5)
      AND      DO: Test Expression
            option=5
   W  AND      DO: Display Form
            WPOS: 10,15,3,50

             Thank you for using the Claims Management System
            COL : SURR      White on Blue
            COL : 0,0       White on Blue

      AND      DO: Quit


[  1] about help
   W IF        DO: Display Form
            WPOS: 4,4,15,70

                        ABOUT HELP


                HELP enables you to access relevant information for
                necessary for you to run CMS for best results.
            WDET: no_border replace

[  2] access other files
   F IF        DO: Display Form


[  3] accessing help files
     IF        DO: Test Expression
            help=1
   F  AND      DO: Menu Question  help1

                        CASE LIST

              1.{London Borough Of Merton v. Stanley Hugh Leach Ltd.(1985) 32BLR51 }

              2.{H. Fairweather & Co.Ltd. v. London Borough of Wandsworth(1987) }

              3.{Wraight Ltd. v. P.H. & T(Holding) Ltd.(1968) 13BLR26 }

              4.{Saint Line Ltd. v. Richardson, Westgarth & Co. Ltd.(1940) 2KB99 }

              5.{Croudace Construction Ltd. v. Cawoods Concrete Products Ltd.(1978) }

              6.{Tate & Lyle Food & Distribution Ltd. v. Greater London Council(1982) }

              7.{Peak Construction(Liverpool) Ltd. v. McKinney Foundations Ltd.(1970)}

              8.{F.G. Minter Ltd. v. Welsh Health Technical Services Organisation}

              9.{Rees & Kirby Ltd v. Swansea Corporation(1985) 5 Con LR 34 }

             10.{Pendivic Contracting Co.Ltd. v. International Nickel Co. of Canada Ltd(1975}

   +  AND [  7] case law files

     OR        DO: Test Expression
            help=2
   +  AND [  8] clause 26
```

```
    OR        DO: Test Expression
              help=3
   +  AND |   1| about help

[  4] Ask for relevant matter                Sp
    IF        DO: Begin Explain
              notes12.80
   F  AND       DO: Menu Question  EMenu1$
                {F}ile              {O}ptions            {H}elp



                              +-----------------------+
                              | RELEVANT  MATTERS    |
                              +-----------------------+

                    Which of the following relevant matters listed in clause 26
                    is the basis of your loss and/or expense claim?

                         1.{deferment of posession of site}
                         2.{discrepancies in or divergences in bills}
                         3.{failure to supply materials}
                         4.{inspection of covered work}
                         5.{lack of instructions}
                         6.{lack of egress or ingress}
                         7.{postponement of works}
                         8.{variation of works}
                         9.{work not part of the contract}
                     *  ---------

[  5] ask whether ready to confirm variation type
   F IF        DO: Menu Question  naturevar$

                       Are you now quite certain of the nature
                       the variation which has been instructed
                       by the Architect?

                        +--------+       +--------+
                        | {YES} |       | {NO  } |
                        +--------+       +--------+

    OR        DO: Test Expression
              Nature$="YES"
     AND       DO: Global Restart

    OR        DO: Test Expression
              Nature$="NO"
     AND       DO: Quit

[  6] ask whether the standard has been certified
   W IF        DO: Menu Question  inspection2$
              WPOS: 6,15,8,52

                   Has the Architect certified that the kind and
                   standard of materials and workmanship are to
                   his satisfaction?

                        YES          NO
              WDET: single_border replace
              COL : SURR      White on Blue
              COL : 0,0       White on Blue

     AND       DO: Test Expression
              inspection2$="YES"

    OR        DO: Test Expression
              inspection2$="NO"
   F  AND       DO: Display Form


                          Where the Achitect has not certified that the
```

```
                    workmanship and standard of materials are to
                    specification of the contract, the cost of
                    carrinying out such an inspection in not a valid
                    loss and/or expense claim.
            COL : SURR       White on Blue
            COL : 0,0        White on Blue

    +  AND [  19] menu to quit system

[  7] case law files
    IF       DO: Test Expression
             help1=1
    F  AND       DO: Menu Question  helpC1

                London Borough of Merton v. Stanley Hugh Leach Ltd.(1985) 32BLR 51

             In 1972 the contractor agreed with Merton to construc 287 dwellings. The
             contract was on{JCT63}terms. The partyies were in dispute over delayed
             completion, the contractor contending that the delay was almost entirely due
             to lack of diligence and care and lack of co-operation by Merton's Architect
             and alleged that Merton were in breach of implied terms of the contract,
             inter alia:

             (i) that Merton would not hinder or prevent the contractor from carrying out
                its obligations in accordance with the terms of the contract and from
                executing the works in a regular and orderly manner; and
             (ii) that Merton would take steps reasonably necessary to enable the contractor
                to discharge its obligations and execute the works in a regular and
                orderly manner.

             Held: Terms were to be implied

                         {exit}        {next page }
          [  8] clause 26
    F IF        DO: Menu Question  cl26help

                   Clause 26- Loss and/or expense


                   {Clause 26.1}- Application for loss and/or expense

                  {Clause 26.2}- Relvant matters

                   {Clause 26.3}- Valuing Loss and/or Expense

                   {Clause 26.4}

                      -- Select option and Press the Enter Key --

[  9] conditions                          Ex
    IF       DO: Begin Explain
             notes5.80
    F  AND       DO: Menu Question  WRITTENS
             {F}ile                {O}ptions               {H}elp

                 It is a requirement that a written application be made
                 to the Architect in respect of any loss and/or expense
                 that has been incurred or is likely to be incurred. Which
                 of the following situation apply in this instance?

                  1.{Application has not been made wish to do so now}

                  2.{Application already made wish to continue}
                 AND       DO: Test Expression
             prompt("Press any key to continue")
    +  AND [  20] Nature of written application
      AND       DO: Begin Explain
             notes7.80
      AND       DO: Test Expression
             prompt("Press any key to continue,F1 for Explanation")
    +  AND [  63] timing
```

```
    AND      DO: End Explain
    AND      DO: Test Expression
             prompt("Press any key to continue")
  W  AND      DO: Help Explain
             WPOS: 7,15,8,50

              The provisions of clause 26 are intended only
              to reimburse the contractor for losses he incurs
              as a result of relevant matters specified and
              for which the employer and/or his agents are
              responsible.

  F  AND      DO: Menu Question  ARCREQUESTS$


                    Where the Architect has requested further details
                    loss and/or expense it important that all such
                    be provided to enable a fair ascetainment to be
                    made. Which of the following situations apply

                      1.{Details of loss and/or expense provided}
                      2.{Details have not been provided}

  +  AND [  46] Response to architect request for information
    AND      DO: Begin Explain
             notes21.80
    AND      DO: End Explain

   OR        DO: Test Expression
             WRITTEN$="H"
  W  AND      DO: Menu Question  helpv
             WPOS: 1,62,4,17
             {Case law     }
             {Clause 26    }
             {Explanations }
                 +  AND [  17] help on question in written application
    AND      DO: Global Restart


[ 10] content of written application                Ex
   IF        DO: Test Expression
             prompt("Press Y for YES, N for NO")
  W  AND      DO: Menu Question  Nature$
             WPOS: 6,15,7,50

               Did the written application state the nature
               and cause of the disruption and its effect on
               the works?

                    {YES}          {NO}
                 +  AND [  48] responses to content of application
[ 11] control of access by the employer              Ex
   IF        DO: Test Expression
             acess2$="YES"
   OR        DO: Test Expression
             acess2$="NO"
  W  AND      DO: Display Form
             WPOS: 5,7, An undertaking to provide access to or from site is not
                   binding if such access is prevented or controlled by
                   third parties.

                   CASE: Neodex Ltd. v. Tottenham Urban Council(1958)

  +  AND [  19] menu to quit system
[ 12] evaluating loss and/or expense                 Ex
   IF        DO: Test Expression
             prompt("Use Cursor to select Option and Press Enter")
  +  AND [  4] Ask for relevant matter
    AND      DO: Fail
```

```
 OR       DO: Test Expression
          EMenu1$="variation of works"
  AND      DO: Begin Explain
          matt16.80
+  AND |  62| Test variationtype
  AND      DO: End Explain
+  AND |  23| option to save consultation
+  AND |  31| printing consultation
+  AND |  19| menu to quit system
 OR       DO: Begin Explain
          matt1.80
  AND      DO: Test Expression
          EMenu1$="lack of instructions"
F  AND      DO: Menu Question  Instruct1$

               A written request to  the Architect  for instructions,
               detailed drawings etc. is a requirement for considering
               for this relevant matter.
                    1.{Send a written request now   }
                    2.{Written request has been sent}
                    3.{Continue consultation        }
               +---------------------------------------------------------+
               |  {CASE LAW}           {CLAUSE 4}          {HELP} |
               +---------------------------------------------------------+
              +  AND |  16| help on instructions
+  AND |  22| option as to instruction request
+  AND |  64| timing of request for instructions
  AND      DO: Begin Explain
          matt2.80
+  AND |   9| conditions
+  AND |  23| option to save consultation
  AND      DO: End Explain
+  AND |  34| printing instruction consultation
+  AND |  19| menu to quit system

 OR       DO: Begin Explain
          notes22.80
  AND      DO: Test Expression
          EMenu1$="deferment of posession of site"
+  AND |  44| Questions on site possesion
  AND      DO: Test Expression
          wait()
  AND      DO: End Explain
+  AND |  23| option to save consultation
+  AND |  32| printing deferment consultation
+  AND |  19| menu to quit system

 OR       DO: Begin Explain
          matt15.80
  AND      DO: Test Expression
          EMenu1$="lack of egress or ingress"
W  AND      DO: Menu Question  acess1$
         WPOS: 6,11,9,59


            Has the employer given express undertaking to provide
            any such access to and from the site?

                 {YES}           {NO}
         WDET: single_border replace
         COL : SURR       White on Blue
         COL : 0,0        White on Blue
         MENU: 5,14,19    Blue on Gray          Lt_Red on Blue
         MENU: 5,35,40    Blue on Gray          Lt_Red on Blue

+  AND |  38| provision of access to site
W  AND      DO: Menu Question  acess2$
         WPOS: 7,11,8,59

             Is the access to the site in question under the
             the control of the employer?
```

```
                {YES}          {NO}
              + AND [ 11] control of access by the employer
+ AND [  9] conditions
F AND       DO: Display Form

                    SUMMARY OF INTERIM FINDINGS
                  **************************************

          The relevant matter  : [relevantmatter$              ]

          Timing of application: reasonable

          Clause           : 26.2.6
                      relevantmatter$
  AND       DO: End Explain
+ AND [ 23] option to save consultation
+ AND [ 30] printing access consultation
+ AND [ 19] menu to quit system
 OR        DO: Begin Explain
          matt9.80
  AND       DO: Test Expression
          EMenu1$="work not part of the contract"
+ AND [ 41] question on works not part of contract
+ AND [ 40] question on who is carrying out the works
+ AND [  9] conditions
F AND       DO: Display Form
                    SUMMARY OF INTERIM FINDINGS
                  **************************************

          The relevant matter  : [relevantmatter$              ]


          Timing of application: reasonable

          Clause           : 26.2.4.1
                      relevantmatter$

  AND       DO: End Explain
+ AND [ 23] option to save consultation
+ AND [ 37] printing work not part of contract consultation
+ AND [ 19] menu to quit system

 OR        DO: Begin Explain
          matt9.80
  AND       DO: Test Expression
          EMenu1$="failure to supply materials"
+ AND [ 39] question on the supply of materials
+ AND [  9] conditions
F AND       DO: Display Form


                    SUMMARY OF INTERIM FINDINGS
                  **************************************

          The relevant matter  : [relevantmatter$              ]

                      Timing of application: reasonable

          Clause           : 26.2.4.2
                      relevantmatter$

+ AND [ 23] option to save consultation
  AND       DO: End Explain
+ AND [ 35] printing materials consultation
+ AND [ 19] menu to quit system

 OR        DO: Begin Explain
          matt12.80
  AND       DO: Test Expression
```

```
          EMenu1$="postponement of works"
+  AND [  43] questions on postponement
+  AND [   9] conditions

F  AND       DO: Display Form

                    SUMMARY OF INTERIM FINDINGS
                  ***************************************

           The relevant matter  : [relevantmatter$                  ]


           Timing of application: reasonable

           Clause          : 26.2.5
                         relevantmatter$

+  AND [  23] option to save consultation
   AND       DO: End Explain
+  AND [  36] printing postponement consultation
+  AND [  19] menu to quit system

 OR        DO: Begin Explain
          matt7.80
   AND       DO: Test Expression
          EMenu1$="inspection of covered work"
+  AND [  45] questions on standard of work
+  AND [   9] conditions
F  AND       DO: Display Form



                    SUMMARY OF INTERIM FINDINGS
                  ***************************************

           The relevant matter  : [relevantmatter$                  ]

           Timing of application: reasonable

           Clause          : 26.2.2
                         relevantmatter$

+  AND [  23] option to save consultation
   AND       DO: End Explain
+  AND [  28] print inspection consultation
+  AND [  19] menu to quit system

 OR        DO: Test Expression
          EMenu1$="Discrepancies in or divergences in bills"
+  AND [  42] questions on discrepancies and divirgences
+  AND [   9] conditions
+  AND [  23] option to save consultation
+  AND [  33] printing discrepancies consultation
+  AND [  19] menu to quit system

 OR        DO: Test Expression
          EMenu1$="H"
W  AND       DO: Menu Question  help
         WPOS: 0,60,6,19
          +----------------+
          ¦ {Case Law}     ¦
          ¦ {Clause 26}    ¦
          ¦ {About Help }  ¦
          ¦                ¦
          +----------------+

+  AND [   3] accessing help files
```

```
     AND      DO: Restart Rule

    OR        DO: Test Expression
            EMenu1$="F"
  W  AND      DO: Menu Question  file
           WPOS: 1,1,5,18
            {Enter Identity}

            {Restart     }

            {Exit        }

[ 13] Evidence of deferment                  Ex
   W IF       DO: Menu Question  documents$
           WPOS: 5,7,10,66


              Do you have documentary evidence to show that the employer
              has deferred possession of site in line with requirements
              clause 23 ?


                    {YES}          {NO }                    .

*    OR       DO: Test Expression
            documents$="no"
  W  AND      DO: Display Form
           WPOS: 5,5,12,70

               Since you have no documentary proof that the employer
               has in fact deferred possesion it will be difficult
               base a claim for loss and/or expense under the
               provisions of clause 26. You may however to claim
               damages at common law as possesion of site is an
               term of any building contract.

               CASE: Arterial Drainage Co. v. Parthangam Drainage
                  Board(1880)

  + AND [ 19] menu to quit system

[ 14] explanation of variation
   W IF       DO: Menu Question  help
           WPOS: 1,62,4,17
            {Case law      }
            {Relevant clause}
            {About Help    }
               AND      DO: Fail

    OR        DO: Test Expression
            help=1
     AND      DO: Test Expression                               .
            cls()
     AND      DO: Test Expression
            dos("more<","cl13")
  + AND [  5] ask whether ready to confirm variation type

    OR        DO: Test Expression
            help=2
     AND      DO: Test Expression
            cls()
     AND      DO: Test Expression
            dos("more<","cl13")
  + AND [  5] ask whether ready to confirm variation type


[ 15] find out whether agents are statutory undertakers
   W IF       DO: Menu Question  statutory_undertakers$
           WPOS: 7,13,8,56
```

```
*                 Are employers agents Statutory undertakers carrying
                  their obligations under statute?

                       {YES }        {NO }

    AND     DO: Test Expression
            statutory_undertakers$="yes"
  W  AND     DO: Display Form
            WPOS: 7,14,8,53

                  In this instance there is no remedy for delays
                  under the provisions under clause 26, however
                  a legitimate claim for extension of time exists
                  under the terms of clause 25.

  + AND [ 19] menu to quit system

    OR      DO: Test Expression
            statutory_undertakers$="no"


[ 16] help on instructions
    IF      DO: Test Expression
            Instruct1$="case law"
     AND     DO: Test Expression
            cls()
     AND     DO: Test Expression
            dos("more<","variate")
     AND     DO: Global Restart

    OR      DO: Test Expression
            Instruct1$="case law"
     AND     DO: Test Expression
            cls()
     AND     DO: Test Expression
            dos("more<","cl4")
     AND     DO: Global Restart


[ 17] help on question in written application
    IF      DO: Test Expression
            helpv=1
     AND     DO: Test Expression
            cls()
     AND     DO: Test Expression
            dos("more","cases")

    OR      DO: Test Expression
            helpv=2
     AND     DO: Test Expression
            cls()
     AND     DO: Test Expression
*

            dos("more","clause3a")

    OR      DO: Test Expression
            helpv=3
     AND     DO: Test Expression
            cls()
     AND     DO: Test Expression
            dos("more","notes1a")

[ 18] Legal text and explantions
    IF      DO: Test Expression
```

```
          WRITTEN$="case law"
     AND     DO: Test Expression
          cls()
     AND     DO: Test Expression
          dos("more<","cases")
     AND     DO: Restart Rule


[ 19] menu to quit system
    F IF       DO: Menu Question  Quit


                    Choose one of the hilighted options:


                      +----------------------+
                      |{RUN NEW CONSULTATION }|
                      +----------------------+


                      +----------------------+
                      |{QUIT SYSTEM        }|
                      +----------------------+
               AND      DO: Test Expression
          Quit=1
     AND     DO: Test Expression
          load("es.kb")

     OR      DO: Test Expression
          Quit=2
     AND     DO: Test Expression
          sleep(2)
   W  AND     DO: Display Form
*
          WPOS: 10,15,3,50

               Thank you for using this system.
          COL : SURR      White on Blue
          COL : 0,0       White on Blue

     AND     DO: Quit


[ 20] Nature of written application                Ex
     IF      DO: Test Expression
          WRITTEN$="application already made wish to continue"
     AND     DO: Test Expression
          prompt("Press any key to continue")
   +  AND [  10] content of written application

     OR      DO: Test Expression
          prompt("Press any key to continue")
     AND     DO: Test Expression
          WRITTEN$="application has not been made wish to do so now"
   +  AND [  27] print application for loss and/or expense
   +  AND [  25] options if no written application


[ 21] OPTION                                 Ex
    W IF       DO: Help Explain
          WPOS: 7,15,10,54


           A written application for any loss and/or expense
           claimed under these provisions should be made to
           the Architect as soon as it has become apparent
           such loss has been incurred or is likely to be
           incurred.
```

```
            WDET: no_border overlay
            COL : SURR      White on Blue
            COL : 0,0       White on Blue

        AND     DO: Test Expression
            Reasonabletime$="YES"

       OR       DO: Test Expression
            Reasonabletime$="NO"
      + AND [  19] menu to quit system


[ 22] option as to instruction request            Sp Ex
    IF        DO: Test Expression
            Instruct1$=("Send a written request now  ")
      + AND [  59] sent out written request

       OR       DO: Test Expression
            Instruct1$=("Written request has been sent")
      W  AND      DO: Display Form
            WPOS: 5,2,13,76

                Clause 26.2.1 states that the contractor's entitlement regarding
              delays in obtaining instructions, details etc. is conditional
              to a request for such information being made to the Architect.
              If no such requests has been made by the contractor,
              claims under this sub-clause cannot be sustained under the
              provisions of clause 26.

            WDET: no_border replace
            COL : SURR      White on Blue
            COL : 0,0       White on Blue


       OR       DO: Test Expression
            Instruct1$=("Continue consultation  ")
      W  AND      DO: Display Form
            WPOS: 5,2,13,76


              Clause 26.2.1 states that the contractor's entitlement regarding
              delays in obtaining instructions, details etc. is conditional
              to a request for such information being made to the Architect.
              If no such requests has been made by the contractor,
              claims under this sub-clause cannot be sustained under the
              provisions of clause 26.


[ 23] option to save consultation                 Ex
    F IF      DO: Menu Question  MENU2


             After going through the legal justification of your claim for loss
             and/or expense which of the menu options would you like to take ?


            +------------------------------------------+  +----------------------+
            |                                  | |{SAVE CONSULTATION  }|
            |* SAVE CONSULTATION- save your responses to|  +----------------------+
            | an ASCII file for later reference and   |
            | prints a summary of your case.          |  +----------------------+
            |                                  | |{CLAIM QUANTIFICATION }|
            |* CLAIM QUANTIFICATION- load program to   |  +----------------------+
            | to estimate claim by access to project  |
            | data saved on spreadsheets or input by  |  +----------------------+
            | you.                              |  |{RUN NEW CONSULTATION }|
```

```
        |                              | +----------------------+
        | * USE cursor keys to select option and   |
        |  press the ENTER key.            | +----------------------+
        |                              | ||QUIT SYSTEM       ||
        +------------------------------------------+ +----------------------+
            AND       DO: Test Expression
        MENU2=1
  + AND [ 24] OPTIONS

   OR        DO: Test Expression
        MENU2=2
    AND       DO: Test Expression
        load("lotus.kb")

   OR        DO: Test Expression
        MENU2=3
    AND       DO: Test Expression
        load("main.kb")

   OR        DO: Test Expression
        MENU2=4
    AND       DO: Quit


[ 24] OPTIONS                          Sp
   W IF       DO: Display Form
        WPOS: 6,15,10,50

          Enter your Name:<username$            >

          Please specify a file name under which you would
          like your consultation to be saved.

                <fname$ >
             (Not more than eight characters)
                     username$
        IN  : 6,17,26    Blue on Gray
            fname$

    AND       DO: Assign Variable
        file$:=fname$



[ 25] options if no written application              Ex
    IF        DO: Test Expression
          prompt("Press F1 for explanation, any Key to continue")
     AND      DO: Begin Explain
          notes4.80
   W  AND      DO: Display Form
        WPOS: 5,10,9,60
                    APPLICATION

           Clause 26.1 requires the contractor to make a
           written application stating the relevant matter
           being relied on. In the absence of such an application
           the architect cannot proceed with the ascertainment
           of the claim.


   W  AND      DO: Display Form
        WPOS: 5,10,8,56
                     OPTION

           The evaluation of your claim will now continue but
           you may seek reimbursement of any loss and expense
           under common law as stipulated by sub-clause 26.6

[ 26] options made
    IF        DO: Test Expression
```

```
            div_notice=1
    AND        DO: Test Expression
            output("lpt1")
  F  AND       DO: Print Form
                                                [date$(now()]
               To the Architect


               Dear Sir,
                    [EMenu1$                      ]
                    ----------------------------------------------

               On examination of the Contract Drawings and Contract Bills we

               find the following discrepencies:

               1.

               2.

               Will you please issue your instructions with regard to these

               discrepancies as soon as possible as it will be impossible for

               us to order the necessary materials until these problems are

               are resolved.

               Yours faithfully,


                                   date$(now())
          OUT : 5,16,61
             EMenu1$

    AND        DO: Test Expression
            output("lpt1")
  F  AND       DO: Print Form



                  [username$        ]
          COL : SURR       White on Blue
*
          COL : 0,0       White on Blue
          OUT : 3,9,31
             username$


   OR          DO: Test Expression
            div_notice=2
  +  AND [  19] menu to quit system


[ 27]  print application for loss and/or expense
   IF         DO: Test Expression
            output("lpt1")
  F  AND       DO: Print Form


                                                [date$(now()]
               To the Architect



               Dear Sir,

                    [EMenu1$                      ]
                    ----------------------------------------------
```

```
                In accordance with clause 26.1 of the contract we hereby make

                application to you that we are likely yo incurr direct loss

                and/or expense in the execution of this Contract, for which we

                will not be reimbursed by a payment under any other provision

                the Contract because the regular progress of the Works is likely

                to be affected by |EMenu1$                        |
                              date$(now())
           OUT : 10,16,61
              EMenu1$
           OUT : 24,25,68
              EMenu1$

    AND       DO: Test Expression
           output("lpt1")
  F  AND      DO: Print Form


                Yours faithfully,


                |username$           |
                  username$


[ 28]  print inspection consultation
     F IF        DO: Menu Question  inspection



               Your consultation has been saved on file called |file$  |.prn.
               Choose one of the options below.

              +-----------------------------------------+  +---------------------+
              |                                         |  ||  PRINT CONSULTATION ||
              |* PRINT  CONSULTATION- prints your response|  +---------------------+
              |  to questions answered during consultation|
              |                                         |  +---------------------+
              |                                         |  ||  QUANTIFY CLAIM     ||
              |* CLAIM QUANTIFICATION- load program to  |  +---------------------+
              |  to estimate claim by access to project |
              |  data saved on spreadsheets or input by |  +---------------------+
              |  you.                                   |  ||RUN NEW CONSULTATION||
              |                                         |  +---------------------+
              |* USE cursor keys to select option and   |
              |  press the ENTER key.                   |  +---------------------+
              |                                         |  ||    QUIT SYSTEM     ||
              +-----------------------------------------+  +---------------------+

               file$

    AND       DO: Test Expression
           inspection=1
    AND       DO: Test Expression
           output("lpt1")
  F  AND      DO: Print Form
                         SUMMARY OF CONSULTATION
              +-------------------------------------------------------------+
              | File name:|file$     |       Date of consultation:|date$(now()) ||
              | User name:|username$               | Time:|time$(now()) |        |
              +-------------------------------------------------------------+
              Which of the relevant matters listed under cluase 26 is the basis of your
              loss and/or expense claim?:|EMenu1$                      |
```

```
Was the standard of work in accordance with the standards and specifications
of the contract? :[inspection1$]

Has the Architect certified that the kind and standard of materials and


workmanship are to his satisfaction?: [inspection2$ ]

Has a written application been submitted to the Architect?:[WRITTEN$  ]

Did the written application state the nature of and cause of the disruption
and its effect on the works? [Nature$]

Has the Architect requested further details following your application
for reimbursement for loss and expense? [ARCREQUEST]

Was the application submitted in reasonable time? [Reasonabletime$ ]
COL : SURR      White on Blue
COL : 0,0      Blue on Gray      COL : 1,0      White on Blue
OUT : 2,15,28
   file$
OUT : 2,63,78
   date$(now())
OUT : 3,15,42
   username$
OUT : 3,50,64
   time$(now())
OUT : 6,29,78
   EMenu1$
OUT : 9,20,33
   inspection1$
OUT : 12,40,54
   inspection2$
OUT : 14,61,72
   WRITTEN$
OUT : 17,31,39
   Nature$
OUT : 20,42,53
   ARCREQUEST$
OUT : 22,52,69
   Reasonabletime$

+ AND [ 53] save inspection consultation

OR      DO: Test Expression
        inspection=2
 AND      DO: Test Expression
        load("lotus")

OR      DO: Test Expression
        inspection=3
 AND      DO: KB Re-run

OR      DO: Test Expression
        inspection=4
 AND      DO: Quit


[ 29] print variation consultation
  IF      DO: Test Expression
        output("lpt1")
 F AND      DO: Print Form

               SUMMARY OF CONSULTATION
     +-------------------------------------------------------------------+
     ¦ File name:[file$      ]      Date of consultation:[date$(now()) ]¦

     ¦ User name:[username$           ] Time:[time$(now()) ]          ¦
     +-------------------------------------------------------------------+
```

```
Which of the relevant matters listed under clause 26 is the basis of your
loss and/or expense claim? [EMenu1$                    ]

Which of the changes the works defined in clause 13 as variation
was the cause of the disruption?:[variationtype$          ]

Has a written application been submitted to the Atchitect?:
      [WRITTEN$                             ]

Did the written application state the nature of and cause of the disruption
and its effect on the works? [Nature$]

Has the Architect requested further details following your application
for reimbursement for loss and expense?
      [ARCREQUEST$                          ]

  Was the application submitted in reasonable time? [Reasonabletime$ ]
COL : SURR      White on Blue
COL : 0,0       White on Blue       COL : 1,0       Blue on Gray
COL : 2,0       White on Blue
OUT : 3,15,28
    file$
OUT : 3,63,78
    date$(now())
OUT : 4,15,42
    username$
OUT : 4,50,64
    time$(now())
OUT : 8,29,78
    EMenu1$
OUT : 11,35,77
    variationtype$
OUT : 14,16,77
    WRITTEN$
OUT : 17,31,39
    Nature$
OUT : 21,15,75
    ARCREQUEST$
OUT : 23,52,69
    Reasonabletime$


[ 30] printing access consultation
   F IF     DO: Menu Question  access_menu


        Your consultation has been saved on file called [file$ ].prn.
        Choose one of the options below.

        +-------------------------------------------+ +----------------------+
        |                                ¦ ¦[ PRINT CONSULTATION ] ¦
        |* PRINT  CONSULTATION- prints your response¦ +----------------------+
        ¦ to questions answered during consultation¦
        |                                ¦ +----------------------+
        |                                ¦ ¦[  QUANTIFY CLAIM  ] ¦
        |* CLAIM QUANTIFICATION- load program to  ¦ +----------------------+
        ¦ to estimate claim by access to project  ¦
        ¦ data saved on spreadsheets or input by  ¦ +----------------------+
        ¦ you.                           ¦ ¦[RUN NEW CONSULTATION] ¦
        |                                ¦ +----------------------+
        |* USE cursor keys to select option and   ¦
        ¦ press the ENTER key.           ¦ +----------------------+
        |                                ¦ ¦[    QUIT SYSTEM   ] ¦
        +-------------------------------------------+ +----------------------+
                        file$

    AND     DO: Test Expression
        access_menu=1
    AND     DO: Test Expression
        output("lpt1")
```

```
F  AND      DO: Print Form
                  SUMMARY OF CONSULTATION
            +-----------------------------------------------------------------------+
            ¦ File name:[file$      ]        Date of consultation:[date$(now()) ]¦
            ¦ User name:[username$              ] Time:[time$(now()) ]          ¦
            +-----------------------------------------------------------------------+

            Which of the relevant matters listed under cluase 26 is the basis of your
            loss and/or expense claim?:[EMenu1$                    ]

            Has the employer given express undertaking to provide any such access
            to or from the site?: [acess1$  ]

            Is the access in question under the control of the employer ? [acess2$ ]

            Has a written application been submitted to the Atchitect?:[WRITTEN$ ]

            Did the written application state the nature of and cause of the disruption
            and its effect on the works? [Nature$]

            Has the Architect requested further details following your application
            for reimbursement for loss and expense? [ARCREQUEST]

            Was the application submitted in reasonable time? [Reasonabletime$ ]
          COL : SURR      White on Blue
          COL : 0,0       Blue on Gray        COL : 1,0      White on Blue
          OUT : 2,15,28
             file$
          OUT : 2,63,78
             date$(now())
          OUT : 3,15,42
             username$
          OUT : 3,50,64
             time$(now())
          OUT : 7,29,78
             EMenu1$
          OUT : 10,24,35
             acess1$

          OUT : 12,64,73
             acess2$
          OUT : 14,61,72
             WRITTEN$
          OUT : 17,31,39
             Nature$
          OUT : 20,42,53
             ARCREQUEST$
          OUT : 22,52,69
             Reasonabletime$

+  AND [  50] save access consultation to disk


[ 31] printing consultation
   F IF      DO: Menu Question  print



             Your consultation has been saved on file called [file$  ].prn.
             Choose one of the options below.

            +------------------------------------------+  +----------------------+
            ¦                                          ¦  ¦{ PRINT CONSULTATION }¦
            ¦* PRINT  CONSULTATION- prints your response¦  +----------------------+
            ¦  to questions answered during consultation¦
            ¦                                          ¦  +----------------------+
            ¦                                          ¦  ¦{  QUANTIFY CLAIM    }¦
            ¦* CLAIM QUANTIFICATION- load program to   ¦  +----------------------+
            ¦  to estimate claim by access to project  ¦
```

```
 ¦ data saved on spreadsheets or input by  ¦ +----------------------+
 ¦ you.                                    ¦ ¦[RUN NEW CONSULTATION]¦
 ¦                                         ¦ +----------------------+
 ¦ * USE cursor keys to select option and  ¦
 ¦ press the ENTER key.                    ¦ +----------------------+
 ¦                                         ¦ ¦[    QUIT SYSTEM     ]¦
 +-----------------------------------------+ +----------------------+
                    file$

   AND     DO: Test Expression
           print=1
 + AND [ 29] print variation consultation
 + AND [ 56] save to disk

  OR       DO: Test Expression
           print=2
   AND     DO: Test Expression
           load("lotus")

  OR       DO: Test Expression        print=3
   AND     DO: Test Expression
*
           load("es")

  OR       DO: Test Expression
           print=4
   AND     DO: Quit


[ 32] printing deferment consultation
     F IF      DO: Menu Question  deferement_menu



              Your consultation has been saved on file called [file$ ].prn.
              Choose one of the options below.

 +-----------------------------------------+ +----------------------+
 ¦                                         ¦ ¦[ PRINT CONSULTATION ]¦
 ¦ * PRINT  CONSULTATION- prints your response¦ +----------------------+
 ¦ to questions answered during consultation¦
 ¦                                         ¦ +----------------------+
 ¦                                         ¦ ¦[  QUANTIFY CLAIM    ]¦
 ¦ * CLAIM QUANTIFICATION- load program to  ¦ +----------------------+
 ¦ to estimate claim by access to project  ¦
 ¦ data saved on spreadsheets or input by  ¦ +----------------------+
 ¦ you.                                    ¦ ¦[RUN NEW CONSULTATION]¦
 ¦                                         ¦ +----------------------+
 ¦ * USE cursor keys to select option and  ¦
 ¦ press the ENTER key.                    ¦ +----------------------+
 ¦                                         ¦ ¦[    QUIT SYSTEM     ]¦
 +-----------------------------------------+ +----------------------+
                    file$

   AND     DO: Test Expression
           deferement_menu=1
   AND     DO: Test Expression
           output("lpt1")
 F AND     DO: Print Form
                   SUMMARY OF CONSULTATION
           +-------------------------------------------------------------------+
           ¦ File name:[file$    ]        Date of consultation:[date$(now()) ]¦
           ¦ User name:[username$             ] Time:[time$(now()) ]          ¦
           +-------------------------------------------------------------------+
           Which of the relevant matters listed under cluase 26 is the basis of your
           loss and/or expense claim?:[EMenu1$                        ]

           Has the giving of possesion of site been deferred by the employer?[siteposses]
```

```
        Do you have documentary evidence proof that the employer has deferred
        possession of site in line with requirements of clause 23 regarding the
        possession of site and its deferment?[documents]

        Has a written application been submitted to the Architect?:[WRITTEN$ ]

        Did the written application state the nature of and cause of the disruption
        and its effect on the works? [Nature$]

        Has the Architect requested further details following your application
        for reimbursement for loss and expense? [ARCREQUEST]

        Was the application submitted in reasonable time? [Reasonabletime$ ]
      COL : SURR      White on Blue
      COL : 0,0      Blue on Gray        COL : 1,0      White on Blue
      OUT : 2,15,28
         file$
      OUT : 2,63,78
         date$(now())
      OUT : 3,15,42
         username$
      OUT : 3,50,64
         time$(now())
      OUT : 6,29,78
         EMenu1$
      OUT : 8,68,79
         sitepossesion$
      OUT : 12,39,49
         documents$
      OUT : 14,61,72
         WRITTEN$
      OUT : 17,31,39
         Nature$
      OUT : 20,42,53
         ARCREQUEST$
      OUT : 22,52,69
         Reasonabletime$

  F  AND      DO: Print Form
                    SUMMARY OF CONSULTATION


         Case reference: Freeman v. Hassler (1900).
      COL : SURR      White on Blue
      COL : 0,0      Blue on Gray        COL : 1,0      White on Blue

  +  AND [ 51] save deferment consultation to disk

   OR        DO: Test Expression
        deferement_menu=2
    AND        DO: Test Expression
        load("lotus")

   OR        DO: Test Expression
        deferement_menu=3
    AND        DO: Test Expression
        load("es")

   OR        DO: Test Expression
        deferement_menu=4
    AND        DO: Quit


[ 33] printing discrepancies consultation
   F IF        DO: Menu Question  discrepancies
*

         Your consultation has been saved on file called [file$  ].prn.
         Choose one of the options below.
```

```
+------------------------------------------+ +----------------------+
|                              | |{ PRINT CONSULTATION } |
| * PRINT CONSULTATION- prints your response| +----------------------+
|  to questions answered during consultation|
|                              | +----------------------+
|                              | |{  QUANTIFY CLAIM  } |
| * CLAIM QUANTIFICATION- load program to | +----------------------+
|  to estimate claim by access to project |
|  data saved on spreadsheets or input by | +----------------------+
|  you.                        | |{RUN NEW CONSULTATION} |
|                              | +----------------------+
| * USE cursor keys to select option and |
|  press the ENTER key.         | +----------------------+
|                              | |{   QUIT SYSTEM   } |
+------------------------------------------+ +----------------------+
                  file$

  AND      DO: Test Expression
         discrepancies=1
  AND      DO: Test Expression
         output("lpt1")
F  AND      DO: Print Form
                  SUMMARY OF CONSULTATION
          +-----------------------------------------------------------------+
          | File name:[file$     ]        Date of consultation:[date$(now()) ]|
          | User name:[username$          ] Time:[time$(now()) ]          |
          +-----------------------------------------------------------------+

          Which of the relevant matters listed under cluase 26 is the basis of your
          loss and/or expense claim?:[EMenu1$                          ]

          Has the divergences in or discrepancies between the contract drawings
          and/or contract bills been made known to the Architect?: [discrepancies$ ]

          Has a written application been submitted to the Architect?:[WRITTEN$ ]

          Did the written application state the nature of and cause of the disruption
          and its effect on the works? [Nature$]

          Has the Architect requested further details following your application
          for reimbursement for loss and expense? [ARCREQUEST]

          Was the application submitted in reasonable time? [Reasonabletime$ ]
         COL : SURR     White on Blue
         COL : 0,0     Blue on Gray       COL : 1,0      White on Blue
         OUT : 2,15,28
            file$
         OUT : 2,63,78
            date$(now())
         OUT : 3,15,42
            username$
         OUT : 3,50,64
            time$(now())
         OUT : 7,29,78
            EMenu1$
         OUT : 10,59,76
            discrepancies$
         OUT : 12,61,72
            WRITTEN$
         OUT : 15,31,39
            Nature$
         OUT : 18,42,53
            ARCREQUEST$
         OUT : 20,52,69
            Reasonabletime$

+  AND [  52] save discrepancies consultation

 OR      DO: Test Expression
        discrepancies=2
```

```
   AND     DO: Test Expression
           load("lotus")

  OR       DO: Test Expression
           discrepancies=3
   AND     DO: KB Re-run

  OR       DO: Test Expression
           discrepancies=4
   AND     DO: Quit

[ 34] printing instruction consultation
     F IF      DO: Menu Question  print_instruction

              Your consultation has been saved on file called [file$  ].prn.
              Choose one of the options below.

             +-------------------------------------------+  +----------------------+
             |                                           |  ||PRINT CONSULTATION}|
             |* PRINT  CONSULTATION- prints your response|  +----------------------+
             |  to questions answered during consultation|
             |                                           |  +----------------------+
             |                                           |  ||  QUANTIFY CLAIM  }|
             |* CLAIM QUANTIFICATION- load program to    |  +----------------------+
             |  to estimate claim by access to project   |
             |  data saved on spreadsheets or input by   |  +----------------------+
             |  you.                                     |  ||RUN NEW CONSULTATION}|
             |                                           |  +----------------------+
             |* USE cursor keys to select option and     |
             |  press the ENTER key.                     |  +----------------------+
             |                                           |  ||   QUIT SYSTEM    }|
             +-------------------------------------------+  +----------------------+
                          file$

   AND     DO: Test Expression
           print_instruction=1
   AND     DO: Test Expression
           output("lpt1")
  F  AND    DO: Print Form
                     SUMMARY OF CONSULTATION
            +----------------------------------------------------------------------+
            | File name:[file$     ]       Date of consultation:[date$(now()) ]|
            | User name:[username$            | Time:[time$(now()) ]           |
            +----------------------------------------------------------------------+
            Which of the relevant matters listed under cluase 26 is the basis of your
            loss and/or expense claim?:[EMenu1$                    |

            Was the request for instructions, details, levels etc. made at such a time
            that in relation to when it was required it was not too close or far in the
            future? : [Instruct2$ |

            Has a request for instructions, details of drawings etc. been made to the
            Architect?: [Instruct1$ ]

            Has a written application been submitted to the Architect?:
                   [WRITTEN$                          ]

            Did the written application state the nature of and cause of the disruption
            and its effect on the works? [Nature$|

            Has the Architect requested further details following your application
            for reimbursement for loss and expense?
                     [ARCREQUESTS$                          |
            Was the application submitted in reasonable time? [Reasonabletime$ |
          COL : SURR       White on Blue
          COL : 0,0        Blue on Gray        COL : 1,0        White on Blue
          OUT : 2,15,28
              file$
          OUT : 2,63,78
              date$(now())
          OUT : 3,15,42
```

```
                usernameS
            OUT : 3,50,64
                timeS(now())
            OUT : 6,29,78
                EMenu1S
            OUT : 10,12,24
                Instruct2S
            OUT : 13,14,26
                Instruct1S
            OUT : 16,17,77
                WRITTENS
            OUT : 19,31,39
                NatureS
            OUT : 23,19,78
                ARCREQUESTS
            OUT : 24,52,69

                ReasonabletimeS

     + AND [ 57] save to disk instuction consultation

      OR       DO: Test Expression
               print_instruction=2
       AND      DO: Test Expression
               load("lotus")

      OR       DO: Test Expression
               print_instruction=3
       AND      DO: KB Re-run

      OR       DO: Test Expression
               print_instruction=4
       AND      DO: Quit
[ 35] printing materials consultation
     F IF      DO: Menu Question  materials

                Your consultation has been saved on file called [fileS' ].prn.
                Choose one of the options below.

                +------------------------------------------+ +---------------------+
                |                               | |{ PRINT CONSULTATION } |
                | * PRINT  CONSULTATION- prints your response| +---------------------+
                | to questions answered during consultation|
                |                               | +---------------------+
                |                               | |{ QUANTIFY CLAIM   } |
                | * CLAIM QUANTIFICATION- load program to  | +---------------------+
                | to estimate claim by access to project  |
                | data saved on spreadsheets or input by  | +---------------------+
                | you.                          | |{RUN NEW CONSULTATION} |
                |                               | +---------------------+
                | * USE cursor keys to select option and   |
                | press the ENTER key.          | +---------------------+
                |                               | |{    QUIT SYSTEM   } |
                +------------------------------------------+ +---------------------+

                fileS

       AND      DO: Test Expression
               materials=1
       AND      DO: Test Expression
               output("lpt1")
     F  AND     DO: Print Form
                          SUMMARY OF CONSULTATION
                +-----------------------------------------------------------------------+
                | File name:[fileS    ]       Date of consultation:[dateS(now()) ]|
                | User name:[usernameS            ] Time:[timeS(now()) ]          |
                +-----------------------------------------------------------------------+

                Which of the relevant matters listed under cluase 26 is the basis of your
                loss and/or expense claim?:[EMenu1S                      ]
```

```
                Has the employer given express undertaking to supply materials for the
                the execution of the works? :[materials_supply$     ]


                Has a written application been submitted to the Atchitect?:[WRITTEN$ ]

                Did the written application state the nature of and cause of the disruption
                and its effect on the works? [Nature$ ]

                Has the Architect requested further details following your application
                for reimbursement for loss and expense? [ARCREQUEST]

                Was the application submitted in reasonable time? [Reasonabletime$ ]
              COL : SURR     White on Blue
              COL : 0,0      Blue on Gray       COL : 1,0      White on Blue
              OUT : 2,15,28
                 file$
              OUT : 2,63,78
                 date$(now())
              OUT : 3,15,42
                 username$
              OUT : 3,50,64
                 time$(now())
              OUT : 7,29,78
                 EMenu1$
              OUT : 10,31,55
                 materials_supply$
              OUT : 13,61,72
                 WRITTEN$
              OUT : 16,31,40
                 Nature$
              OUT : 19,42,53
                 ARCREQUEST$
              OUT : 21,52,69
                 Reasonabletime$

      + AND [ 54] save materials supply consultation

       OR        DO: Test Expression
              materials=2
        AND      DO: Test Expression
              load("lotus")

       OR        DO: Test Expression
              materials=3
        AND      DO: KB Re-run

       OR        DO: Test Expression
              materials=4
        AND      DO: Quit


[ 36] printing postponement consultation
      F IF       DO: Menu Question  postponement


                Your consultation has been saved on file called [file$ ].prn.
                Choose one of the options below.

              +------------------------------------------+ +----------------------+
              |                              | |[ PRINT CONSULTATION ] |
              |* PRINT  CONSULTATION- prints your response|  +----------------------+
              | to questions answered during consultation|
              |                              | +----------------------+
              |                              | |[  QUANTIFY CLAIM  ] |
              |* CLAIM QUANTIFICATION- load program to   | +----------------------+
              | to estimate claim by access to project  |
              | data saved on spreadsheets or input by  | +----------------------+
              | you.                           | |[RUN NEW CONSULTATION] |
              |                              | +----------------------+
```

```
        | * USE cursor keys to select option and    |
        |  press the ENTER key.                     | +----------------------+
        |                                     | ||    QUIT SYSTEM    ||
        +-----------------------------------------+ +----------------------+
      COL : SURR      White on Blue
      COL : 0,0       White on Blue
      MENU: 8,52,73   Blue on Gray        Lt_Red on Blue
      MENU: 12,52,73  Blue on Gray        Lt_Red on Blue
      MENU: 16,52,73  Blue on Gray        Lt_Red on Blue
      MENU: 20,52,73  Blue on Gray        Lt_Red on Blue
      OUT : 4,52,60
         file$

   AND     DO: Test Expression
        postponement=1
   AND     DO: Test Expression
        output("lpt1")
 F  AND    DO: Print Form
                    SUMMARY OF CONSULTATION
        +------------------------------------------------------------------+
        | File name:[file$     ]        Date of consultation:[date$(now()) ]|
        | User name:[username$            ] Time:[time$(now()) ]           |
        +------------------------------------------------------------------+



        Which of the relevant matters listed under cluase 26 is the basis of your
        loss and/or expense claim?:[EMenu1$                    ]

        Has the Architect issued a written instruction to postpone all or part  of
        the works?: [postpone$     ]

        Has a written application been submitted to the Architect?:[WRITTEN$ ]

        Did the written application state the nature of and cause of the disruption
        and its effect on the works? [Nature$ ]

        Has the Architect requested further details following your application
        for reimbursement for loss and expense? [ARCREQUEST]

        Was the application submitted in reasonable time? [Reasonabletime$ ]
      COL : SURR      White on Blue
      COL : 0,0       Blue on Gray        COL : 1,0      White on Blue
      OUT : 2,15,28
         file$
 *     OUT : 2,63,78
         date$(now())
      OUT : 3,15,42
         username$
      OUT : 3,50,64
         time$(now())
      OUT : 8,29,78
         EMenu1$
      OUT : 11,14,31
         postpone$
      OUT : 13,61,72
         WRITTEN$
      OUT : 16,31,40
         Nature$
      OUT : 19,42,53
         ARCREQUEST$
      OUT : 21,52,69
         Reasonabletime$

 +  AND [  55] save postponement consultation

  OR       DO: Test Expression
        postponement=2
   AND     DO: Test Expression
        load("lotus")
```

```
OR      DO: Test Expression
        postponement=3
 AND      DO: KB Re-run

OR      DO: Test Expression
        postponement=4
 AND      DO: Quit


[ 37] printing work not part of contract consultation
  F IF    DO: Menu Question  work_not_part

          Your consultation has been saved on file called [file$  ].prn.
          Choose one of the options below.

        +-----------------------------------------+ +---------------------+
        |                              | |{ PRINT CONSULTATION } |
        | * PRINT  CONSULTATION- prints your response| +---------------------+
        |  to questions answered during consultation|
        |                              | +---------------------+
        |                              | |{  QUANTIFY CLAIM  } |
        | * CLAIM QUANTIFICATION- load program to  | +---------------------+
        |  to estimate claim by access to project  |
        |  data saved on spreadsheets or input by  | +---------------------+
        |  you.                        | |{RUN NEW CONSULTATION} |
        |                              | +---------------------+
        | * USE cursor keys to select option and   |
        |  press the ENTER key.                    | +---------------------+
        |                              | |{   QUIT SYSTEM   } |
        +-----------------------------------------+ +---------------------+
                OUT : 4,52,60
          file$

 AND      DO: Test Expression
        work_not_part=1
 AND      DO: Test Expression
        output("lpt1")
F  AND    DO: Print Form
                SUMMARY OF CONSULTATION
        +--------------------------------------------------------------+
        | File name:[file$      ]        Date of consultation:[date$(now())  |
        | User name:[username$           | Time:[time$(now()) ]         |
        +--------------------------------------------------------------+
        Which of the relevant matters listed under cluase 26 is the basis of your
        loss and/or expense claim?:[EMenu1$                     ]

        Has the execution of work by the employer or his agents caused unforseeable
        delay and disruption to the contractor's own works? [work_not_part_ofcontrac]

        Is the work in question being carried out by the employer himself?:[work_not_]

        Are the employer's agents statutory undertakers carrying out their obligations
        under statute? :[statutory_undertakers$      ]

        Has a written application been submitted to the Architect?:[WRITTEN$  ]

        Did the written application state the nature of and cause of the disruption
        and its effect on the works? [Nature$]

        Has the Architect requested further details following your application
        for reimbursement for loss and expense? [ARCREQUEST]

        Was the application submitted in reasonable time? [Reasonabletime$ ]
       COL : SURR       White on Blue
       COL : 0,0        Blue on Gray        COL : 1,0       White on Blue
       OUT : 2,15,28
          file$
       OUT : 2,63,78
          date$(now())
       OUT : 3,15,42
```

```
            username$
        OUT : 3,50,64
            time$(now())
        OUT : 6,29,78
            EMenu1$
        OUT : 9,54,78
            work_not_part_ofcontract1$
        OUT : 11,69,79
            work_not_part_ofcontract$
        OUT : 14,18,50
            statutory_undertakers$
        OUT : 16,61,72
            WRITTEN$
        OUT : 19,31,39
            Nature$
        OUT : 22,42,53
*
            ARCREQUEST$
        OUT : 24,52,69
            Reasonabletime$

  + AND [ 58] save work not part of contract consultation

   OR        DO: Test Expression
          work_not_part=2
    AND      DO: Test Expression
          load("lotus")

   OR        DO: Test Expression
          work_not_part=3
    AND      DO: Test Expression
          load("es")

   OR        DO: Test Expression
          work_not_part=4
    AND      DO: Quit


[ 38] provision of access to site                 Ex
   IF        DO: Test Expression
          acess1$="YES"

   OR        DO: Test Expression
          acess1$="NO"
  F  AND     DO: Display Form


                 If the employer has not given express undertaking
                 to enable egress from or ingress to the site than
                 delays resulting from access are not a basis for
                 loss and/or expense claims.

                 CASE:Porter v. Tottenham Urban Council(1915)
        COL : SURR      White on Blue
        COL : 0,0       White on Blue

  + AND [ 19] menu to quit system

[ 39] question on the supply of materials
  W IF       DO: Menu Question  materials_supply$
        WPOS: 6,13,9,54


            Has the employer given express undertaking to
            supply materials for the execution of the works?


                 {YES}       {NO }
        WDET: single_border replace
*
```

```
    AND     DO: Test Expression
            materials_supply$="YES"

    OR      DO: Test Expression
            materials_supply$="NO"
  W  AND    DO: Display Form
         WPOS: 6,13,8,55


            Since the employer has not given an undertaking
            under contract to supply materials for the
            execution of works he cannot be held liable
            for any loss and/or expense incurred.
         COL : SURR      White on Blue
         COL : 0,0       White on Blue

  +  AND [  19] menu to quit system


[ 40] question on who is carrying out the works
   W IF     DO: Menu Question  work_not_part_ofcontract1$
         WPOS: 7,16,8,50

            Is the work in question being carried out by the
            employer himself?

                {YES}      {NO}
         WDET: single_border replace
         COL : SURR      White on Blue
         COL : 0,0       White on Blue
         MENU: 4,10,16   Blue on Gray        Lt_Red on Blue
         MENU: 4,25,31   Blue on Gray        Lt_Red on Blue

    AND     DO: Test Expression
            work_not_part_ofcontract1$="yes"

    OR      DO: Test Expression
            work_not_part_ofcontract1$="no"
  +  AND [  15] find out whether agents are statutory undertakers


[ 41] question on works not part of contract
   W IF     DO: Menu Question  work_not_part_ofcontract$
         WPOS: 6,15,8,54

            Has the execution of work by the employer or his
            agents caused unforseeable delay and disruption
            to the contractor's own works?


                 {YES}      {NO}
         WDET: single_border replace
         COL : SURR      White on Blue
         COL : 0,0       White on Blue
*
         MENU: 6,16,21   Blue on Gray        Lt_Red on Blue
         MENU: 6,31,36   Blue on Gray        Lt_Red on Blue

    AND     DO: Test Expression
            work_not_part_ofcontract$="YES"

    OR      DO: Test Expression
            work_not_part_ofcontract$="NO"
  F  AND    DO: Display Form


                Where the works to be undertaken were made
                known to the contractor, he must make provision
```

```
                         for this scheduling the works in terms of cost
                         and duration A claim under the circumstances
                         cannot be sustained under the provisions of
                         clause 26.
               COL : SURR      White on Blue
               COL : 0,0       White on Blue

      + AND [ 23] option to save consultation
      + AND [ 19] menu to quit system


[ 42] questions on discrepancies and divirgences
      W IF        DO: Menu Question  discrepancies$
               WPOS: 7,13,9,57
                    {O}ption              {H}elp

                    Has the divergences in or discrepancies between
                    the Contract Drawings and/or Contract Bills been
                    made known to the Architect in writing?

                         { YES }       { NO  }

        AND       DO: Test Expression
              discrepancies$="YES"

       OR        DO: Test Expression
              discrepancies$="NO"
      F  AND       DO: Menu Question  div_notice


                       It is an express provision of contract that any
*                        discrepancies and/or divergences in the contract
                       bills be made known to the Architect. Given that
                       the Architect has not been notified, what action
                       do you wish to take?


                         1.{Send notice to the Architect now }

                         2.{Continue with consultation      }

      + AND [ 26] options made
      W  AND       DO: Display Form
               WPOS: 7,14,8,53

                    Under the condition of contract if the Architect
                    is not notified of such discrepancies in or
                    divergences in the contract documents any claims
                    resulting from it cannot be sustained under the
                    provisions of clause 26.


       OR        DO: Test Expression
              discrepancies$="H"
      W  AND       DO: Menu Question  help
               WPOS: 7,41,6,18
                +----------------+
                | {Case Law}     |
                | {Clause 26}    |
                | {About Help }  |
                |                |
                +----------------+


[ 43] questions on postponement
      W IF        DO: Menu Question  postpone$
               WPOS: 6,14,8,54

                    Has the Architect issued a written instruction
                    to postpone all or part of the works?
```

```
                    {YES}         {NO}

    AND      DO: Test Expression
             postpone$="YES"

    OR       DO: Test Expression
             postpone$="NO"
  W  AND     DO: Display Form
          WPOS: 6,14,8,54

               If no instructions has been issued under the
               the provisions of clause 23 then a claim for
               loss and/or expense cannot be sustained under
               the provisions of clause 26.

  +  AND [  19] menu to quit system


[ 44] Questions on site possesion                 Ex
   W IF      DO: Menu Question  sitepossesion$
          WPOS: 6,15,7,50

               Has the giving of possession of site been
               deferred by the employer?

                    {YES}         {NO}

    AND      DO: Test Expression
             sitepossesion$="YES"
  +  AND [  13] Evidence of deferment
  +  AND [   9] conditions
  W  AND     DO: Display Form
          WPOS: 8,12,8,55

             Loss and expenses incurred as a result of deferment
             of possession of site is a relevant matter for which
             the contractor can be reimbursed.

                  CASE: Freeman v. Hessler(1900)
          COL : SURR      White on Blue
          COL : 0,0       White on Blue


    OR       DO: Test Expression
             sitepossesion$="NO"
  F  AND     DO: Display Form


                    If no such instructions regarding the possesion
                    of the site has been given then in law this
                    matter cannot form the basis of a loss and expense
                    claim. However, it is an implied term of any building
                    contract that possession of site shall be granted to
                    the contractor within a reasonable period after the
                    signing of the contract.

                    CASE: Carr v. J.A. Berriman Pty(1953)
                 +  AND [   9] conditions
  +  AND [  19] menu to quit system
[ 45] questions on standard of work
   W IF      DO: Menu Question  inspection1$
          WPOS: 7,13,7,55

               Did the inspection of the work and materials show
               that the standards and specifications of the
```

```
                    contract have been complied with?

                           {YES }        { NO }

        AND      DO: Test Expression
                 inspection1$="YES"
      +  AND [  6] ask whether the standard has been certified


[ 46] Response to architect request for information        Ex
     W IF        DO: Help Explain
                 WPOS: 6,9,10,63

                     Unless the architect or quantity surveyor is
                     provided with the necessary details of the loss
                     and expense the acsertainment cannot be carried
                     out. Failure to provide details means any
                     assessment will be subject largely to the opinion
                     of the architect.

        AND      DO: Test Expression
                 ARCREQUEST$="Details have not been provided"
      +  AND [ 47] response to architect's request for information

       OR        DO: Test Expression
                 ARCREQUEST$="Details of loss and/or expense provided"
*

[ 47] response to architect's request for information       Ex
     F IF        DO: Display Form

                        If the Architect has requested details of losss and/or
                        expense then provide the following details.

                        Date of application       :<date_of_applica>

                        Date of Architect's request:<date_arch_request >
                 COL : SURR       White on Blue
                 COL : 0,0        White on Blue
                 IN  : 12,41,57   Blue on Gray
                     date_of_application$
                 IN  : 15,41,60,0 Blue on Gray
                     date_arch_request

     F  AND      DO: Menu Question  INFORM$

                          Do you wish to send the details of loss an/or expense
                          requested by the Architect?

                               {YES}       { NO }

                    The provisions of contract allows the Architect
                    to request any further details of loss and/or
                    expense that will help him to ascertain the
                    claim.

        AND      DO: Test Expression
                 INFORM$="yes"
        AND      DO: Test Expression
                 load("lotus2")
*

        OR       DO: Test Expression
```

```
            INFORM$="NO"
    W  AND      DO: Display Form
          WPOS: 2,15,8,57

            If the contractor fails to provide further details
            of the loss and/or expense, then the assessment of
            such loss will depend entirely on the judgement of
            the Architect.


[ 48] responses to content of application          Ex
     IF        DO: Test Expression
               prompt("Press any key to continue")
      AND      DO: Test Expression
               Nature$="yes"
    W  AND      DO: Display Form
          WPOS: 8,10,6,60

              Clause 26.1 requires the contractor to state in
              the written application the relevant matter
              which has disrupted or is likely to disrupt the
              regular progress of the works.
          COL : SURR      White on Blue
          COL : 0,0       White on Blue


     OR        DO: Test Expression
               prompt("Press F1 for Explanation and any other Key to continue")
      AND      DO: Begin Explain
               notes5.80
      AND      DO: Test Expression
               Nature$="no"
    W  AND      DO: Display Form
          WPOS: 7,12,8,60

              The contract requires that an application for
              loss and expense should indicate to the architect
              the relevant matter causing the disruption and
              what effect it has had or likely to have on the
              regular progress of the works.
          COL : SURR      White on Blue
          COL : 0,0       White on Blue

    W  AND      DO: Display Form
          WPOS: 7,15,6,53

             Under this circumstances the Architect opinion
             on the nature will determine the acceptance or
             otherwise of your claim for loss and/or expense
          COL : SURR      White on Blue
          COL : 0,0       White on Blue

      AND      DO: End Explain


*
[ 49] Restart after reading information
    F IF       DO: Menu Question  Restart$



                          RESTART MENU


                 In the light of the information provided are you now able
                 answer the question on which of the relevant matters is
                 the basis of your claim  for loss and/or expense ?
```

```
                    +-----------+      +-----------+
                    ¦ {YES} ¦          ¦ {NO} ¦
                    +-----------+      +-----------+

    AND     DO: Fail

   OR       DO: Test Expression
            Restart$="Yes"
    AND     DO: Test Expression
            load("es")

   OR       DO: Test Expression
            Restart$="No"
    AND     DO: Test Expression
            prompt("Press ESC to Quit")
 W  AND     DO: Display Form
           WPOS: 8,15,8,50

            In view of your inability to state which of the
            relevant matters which clause 26 specifically
            refers, as basis of your claim, it is
            unlikely that you would be able to secure a
            settlement on this claim.
           COL : SURR      White on Blue
           COL : 0,0       White on Blue

 +  AND [ 23] option to save consultation
    AND     DO: Quit


[ 50] save access consultation to disk
    IF      DO: Test Expression
            output(file$)
  F AND     DO: Print Form
                        SUMMARY OF CONSULTATION
            +------------------------------------------------------------------------+
            ¦ File name:[file$     ]        Date of consultation:[date$(now()) ]¦
            ¦ User name:[username$            ] Time:[time$(now()) ]          ¦
            +------------------------------------------------------------------------+
*

            Which of the relevant matters listed under cluase 26 is the basis of your
            loss and/or expense claim?:[EMenu1$                          ]

            Has the employer given express undertaking to provide any such access
            to or from the site?: [acess1$  ]

            Is the access in question under the control of the employer ? [acess2$ ]

            Has a written application been submitted to the Atchitect?:[WRITTEN$ ]

            Did the written application state the nature of and cause of the disruption
            and its effect on the works? [Nature$]

            Has the Architect requested further details following your application
            for reimbursement for loss and expense? [ARCREQUEST$]

            Was the application submitted in reasonable time? [Reasonabletime$ ]
           COL : SURR      White on Blue
           COL : 0,0       Blue on Gray       COL : 1,0      White on Blue
           OUT : 2,15,28
             file$
           OUT : 2,63,78
             date$(now())
           OUT : 3,15,42
             username$
           OUT : 3,50,64
             time$(now())
           OUT : 7,29,79
```

```
        EMenu1$
    OUT : 10,24,35
        acess1$
    OUT : 12,64,73
        acess2$
    OUT : 14,61,72
        WRITTEN$
    OUT : 17,31,39
        Nature$
    OUT : 20,42,54
        ARCREQUESTS$
    OUT : 22,52,69
        Reasonabletime$


[ 51] save deferment consultation to disk
   IF        DO: Test Expression
             output(file$)
   F  AND       DO: Print Form
                        SUMMARY OF CONSULTATION
             +--------------------------------------------------------------------------+
             ¦ File name:|file$      |          Date of consultation:|date$(now()) |¦
             ¦ User name:|username$              | Time:|time$(now()) |          ¦
             +--------------------------------------------------------------------------+
             Which of the relevant matters listed under cluase 26 is the basis of your
             loss and/or expense claim?:|EMenu1$                              |

             Has the giving of possesion of site been deferred by the employer?|siteposses|

             Do you have documentary evidence proof that the employer has deferred

             possession of site in line with requirements of clause 23 regarding the
             possession of site and its deferment?|documents$   |

             Has a written application been submitted to the Architect?: |WRITTEN$   |

             Did the written application state the nature of and cause of the disruption
             and its effect on the works?: |Nature$  |

             Has the Architect requested further details following your application
             for reimbursement for loss and expense? |ARCREQUEST|

             Was the application submitted in reasonable time? |Reasonabletime$ |
    COL : SURR       White on Blue
    COL : 0,0        Blue on Gray          COL : 1,0        White on Blue
    OUT : 2,15,28
        file$
    OUT : 2,63,78
        date$(now())
    OUT : 3,15,42
        username$
    OUT : 3,50,64
        time$(now())
    OUT : 6,29,78
        EMenu1$
    OUT : 8,68,79
        sitepossesion$
    OUT : 12,39,53
        documents$
    OUT : 14,62,74
        WRITTEN$
    OUT : 17,32,42
        Nature$
    OUT : 20,42,53
        ARCREQUESTS$
    OUT : 22,52,69
        Reasonabletime$
```

```
[ 52] save discrepancies consultation
      IF        DO: Test Expression
                output(file$)
    F  AND        DO: Print Form
                         SUMMARY OF CONSULTATION
                +-------------------------------------------------------------------------+
                ¦ File name:[file$     |          Date of consultation:[date$(now())  |¦
                ¦ User name:[username$              | Time:[time$(now()) |           ¦
                +-------------------------------------------------------------------------+

                Which of the relevant matters listed under cluase 26 is the basis of your
                loss and/or expense claim?:[EMenu1$                          |

                Has the divergences in or discrepancies between the contract drawings
                and/or contract bills been made known to the Architect?: [discrepancies$  |

                Has a written application been submitted to the Architect?:[WRITTEN$  |

                Did the written application state the nature of and cause of the disruption
                and its effect on the works? [Nature$]

*                 Has the Architect requested further details following your application
                for reimbursement for loss and expense? [ARCREQUEST]

                 Was the application submitted in reasonable time? [Reasonabletime$ |
              COL : SURR      White on Blue
              COL : 0,0       Blue on Gray          COL : 1,0        White on Blue
              OUT : 2,15,28
                 file$
              OUT : 2,63,78
                 date$(now())
              OUT : 3,15,42
                 username$
              OUT : 3,50,64
                 time$(now())
              OUT : 7,29,78
                 EMenu1$
              OUT : 10,59,76
                 discrepancies$
              OUT : 12,61,72
                 WRITTEN$
              OUT : 15,31,39
                 Nature$
              OUT : 18,42,53
                 ARCREQUEST$
              OUT : 20,52,69
                 Reasonabletime$

[ 53] save inspection consultation
      IF        DO: Test Expression
                output(file$)
    F  AND        DO: Print Form
                         SUMMARY OF CONSULTATION
                +-------------------------------------------------------------------------+
                ¦ File name:[file$     |          Date of consultation:[date$(now())  |¦
                ¦ User name:[username$              | Time:[time$(now()) |           ¦
                +-------------------------------------------------------------------------+
                Which of the relevant matters listed under cluase 26 is the basis of your
                loss and/or expense claim?:[EMenu1$                          |

                Was the standard of work in accordance with the standards and specifications
                of the contract? :[inspection1$]

                Has the Architect certified that the kind and standard of materials and
                workmanship are to his satisfaction?: [inspection2$ |

                Has a written application been submitted to the Architect?:[WRITTEN$  |

                Did the written application state the nature of and cause of the disruption
                and its effect on the works? [Nature$]
```

```
      Has the Architect requested further details following your application
      for reimbursement for loss and expense? |ARCREQUEST|

      Was the application submitted in reasonable time? |Reasonabletime$ |
    COL : SURR      White on Blue
    COL : 0,0       Blue on Gray        COL : 1,0       White on Blue
    OUT : 2,15,28
       file$
*
    OUT : 2,63,78
       date$(now())
    OUT : 3,15,42
       username$
    OUT : 3,50,64
       time$(now())
    OUT : 6,29,78
       EMenu1$
    OUT : 9,20,33
       inspection1$
    OUT : 12,40,54
       inspection2$
    OUT : 14,61,72
       WRITTEN$
    OUT : 17,31,39
       Nature$
    OUT : 20,42,53
       ARCREQUEST$
    OUT : 22,52,69
       Reasonabletime$

[ 54] save materials supply consultation
   IF      DO: Test Expression
           output(file$)
  F AND     DO: Print Form
                       SUMMARY OF CONSULTATION
      +-------------------------------------------------------------------+
      | File name:|file$     |        Date of consultation:|date$(now()) ||
      | User name:|username$           | Time:|time$(now()) |           |
      +-------------------------------------------------------------------+

      Which of the relevant matters listed under clause 26 is the basis of your
      loss and/or expense claim?:|EMenu1$                          |

      Has the employer given express undertaking to supply materials for the
      the execution of the works? :|materials_supply$     |


      Has a written application been submitted to the Architect?:|WRITTEN$  |

      Did the written application state the nature of and cause of the disruption
      and its effect on the works? |Nature$ |

      Has the Architect requested further details following your application
      for reimbursement for loss and expense? |ARCREQUEST|

      Was the application submitted in reasonable time? |Reasonabletime$ |
    COL : SURR      White on Blue
    COL : 0,0       Blue on Gray        COL : 1,0       White on Blue
    OUT : 2,15,28
       file$
    OUT : 2,63,78
       date$(now())
    OUT : 3,50,64
       time$(now())
    OUT : 7,29,78
       EMenu1$
    OUT : 10,31,55

       materials_supply$
    OUT : 13,61,72
       WRITTEN$
```

```
      OUT : 16,31,40
         Nature$
      OUT : 19,42,53
         ARCREQUESTS
      OUT : 21,52,69
         Reasonabletime$

[ 55] save postponement consultation
   IF      DO: Test Expression
           output(file$)
  F  AND     DO: Print Form
                         SUMMARY OF CONSULTATION
        +--------------------------------------------------------------------------+
        ¦ File name:[file$      |         Date of consultation:[date$(now())  |¦
        ¦ User name:[username$              | Time:[time$(now()) |            ¦
        +--------------------------------------------------------------------------+


        Which of the relevant matters listed under cluase 26 is the basis of your
        loss and/or expense claim?:[EMenu1$                        |

        Has the Architect issued a written instruction to postpone all or part  of
        the works?: [postpone$      |

        Has a written application been submitted to the Architect?:[WRITTEN$   |

        Did the written application state the nature of and cause of the disruption
        and its effect on the works? [Nature$  |

        Has the Architect requested further details following your application
        for reimbursement for loss and expense? [ARCREQUEST]

        Was the application submitted in reasonable time? [Reasonabletime$ |
      COL : SURR     White on Blue
      COL : 0,0      Blue on Gray        COL : 1,0      White on Blue
      OUT : 2,15,28
         file$
      OUT : 2,63,78
         date$(now())
      OUT : 3,15,42
         username$
      OUT : 3,50,64
         time$(now())
      OUT : 8,29,78
         EMenu1$
      OUT : 11,14,31
         postpone$
      OUT : 13,61,73
         WRITTEN$
      OUT : 16,31,41
         Nature$
      OUT : 19,42,53
         ARCREQUESTS
      OUT : 21,52,69
         Reasonabletime$



[ 56] save to disk
   IF      DO: Test Expression
           output(file$)
  F  AND     DO: Print Form

                         SUMMARY OF CONSULTATION
        +--------------------------------------------------------------------------+
        ¦ File name:[file$      |         Date of consultation:[date$(now())  |¦
        ¦ User name:[username$              | Time:[time$(now()) |            ¦
        +--------------------------------------------------------------------------+

        Which of the relevant matters listed under cluase 26 is the basis of your
        loss and/or expense claim? [EMenu1$                        |
```

```
        Which of the changes the works defined in clause 13 as variation
        was the cause of the disruption?:
           [variationtypeS                     |
        Has a written application been submitted to the Architect?:
             [WRITTENS                       |

        Did the written application state the nature of and cause of the disruption
        and its effect on the works? [NatureS]

        Has the Architect requested further details following your application
        for reimbursement for loss and expense?
             [ARCREQUESTS                        |

        Was the application submitted in reasonable time? [ReasonabletimeS |
                       dateS(now())
      OUT : 4,15,42
         usernameS
      OUT : 4,50,64
         timeS(now())
      OUT : 8,29,78
         EMenu1S
      OUT : 12,7,76
         variationtypeS
      OUT : 14,11,69
         WRITTENS
      OUT : 17,31,39
         NatureS
      OUT : 21,12,75
         ARCREQUESTS
      OUT : 23,52,69
         ReasonabletimeS



[ 57] save to disk instuction consultation
   IF       DO: Test Expression
            output(fileS)
  F  AND       DO: Print Form
                      SUMMARY OF CONSULTATION
        +------------------------------------------------------------------------+
        | File name:[fileS      |        Date of consultation:[dateS(now()) |
        | User name:[usernameS              | Time:[timeS(now()) |          |
        +------------------------------------------------------------------------+
        Which of the relevant matters listed under cluase 26 is the basis of your
        loss and/or expense claim?:[EMenu1S                        |

        Was the request for instructions, details, levels etc. made at such a time
        that in relation to when it was required it was not too close or far in the
        future? : [Instruct2S |

        Has a request for instructions, details of drawings etc. been made to the
        Architect?: [Instruct1S                    |

        Has a written application been submitted to the Architect?:
             [WRITTENS                         |
        Did the written application state the nature of and cause of the disruption
        and its effect on the works?  [NatureS]

        Has the Architect requested further details following your application
        for reimbursement for loss and expense?
              [ARCREQUESTS                       |

        Was the application submitted in reasonable time? [ReasonabletimeS |
      COL : SURR     White on Blue
      COL : 0,0      Blue on Gray        COL : 1,0      White on Blue
      OUT : 2,15,28
         fileS
      OUT : 2,63,78
         dateS(now())
```

```
OUT : 3,15,42
    username$
OUT : 3,50,64
    time$(now())
OUT : 6,29,79
    EMenu1$
OUT : 10,12,24
    Instruct2$
OUT : 13,14,63
    Instruct1$
OUT : 16,12,77
    WRITTEN$
OUT : 18,33,41
    Nature$
OUT : 22,15,78
    ARCREQUEST$
OUT : 24,52,69
    Reasonabletime$



[ 58] save work not part of contract consultation
    IF        DO: Test Expression
              output(file$)
   F  AND      DO: Print Form
                        SUMMARY OF CONSULTATION
              +------------------------------------------------------------------------+
*              | File name:|file$      |        Date of consultation:|date$(now()) ||
              | User name:|username$             | Time:|time$(now()) |          |
              +------------------------------------------------------------------------+
              Which of the relevant matters listed under cluase 26 is the basis of your
              loss and/or expense claim?:|EMenu1$                    |

              Has the execution of work by the employer or his agents caused unforseeable
              delay and disruption to the contractor's own works? |work_not_part_ofcontrac|

              Is the work in question being carried out by the employer himself?:|work_not_|

              Are the employer's agents statutory undertakers carrying out their obligations
              under statute? :|statutory_undertakers$      |

              Has a written application been submitted to the Architect?:|WRITTEN$  |

              Did the written application state the nature of and cause of the disruption
              and its effect on the works? |Nature$|

              Has the Architect requested further details following your application
              for reimbursement for loss and expense? |ARCREQUEST|

              Was the application submitted in reasonable time? |Reasonabletime$ |
             COL : SURR      White on Blue
             COL : 0,0       Blue on Gray       COL : 1,0      White on Blue
             OUT : 2,15,28
                file$
             OUT : 2,63,78
                date$(now())
             OUT : 3,15,42
                username$
             OUT : 3,50,64
                time$(now())
             OUT : 6,29,78
                EMenu1$
             OUT : 9,54,78
                work_not_part_ofcontract$
             OUT : 11,69,79
                work_not_part_ofcontract1$
             OUT : 14,18,50
                statutory_undertakers$
             OUT : 16,61,72
                WRITTEN$
```

```
        OUT : 19,31,39
            Nature$
        OUT : 22,42,53
            ARCREQUEST$
        OUT : 24,52,69
            Reasonabletime$



[ 59] sent out written request
    + IF   [ 61] take details of instructions required
      AND      DO: Test Expression
               output("lpt1")
    F  AND     DO: Print Form

               To the Architect                  [date$(now())]


               Dear Sir,

                 [heading$                                 ]
                 ----------------------------------------------------------


               We hereby apply for the following information  required by us

               for the carrying out and completion of Works:


               Information description              Date required

               [details1$                    |   [date$(date1)  |

               [details2$                    |   [date$(date2)  |


               Yours faithfully
        COL : SURR       White on Blue
        COL : 0,0        White on Blue
        OUT : 3,57,70
            date$(now())
        OUT : 8,12,71
            heading$
        OUT : 19,9,47
            details1$
        OUT : 19,53,69
            date$(date1)
        OUT : 21,9,47
            details2$
        OUT : 21,53,69
            date$(date2)



[ 60] take details of contract
    IF         DO: Test Expression
               prompt("Please type in the Details")
    F  AND     DO: Display Form



                    Please enter your name below


                 :<username$                      >
        COL : SURR       White on Blue
        COL : 0,0        White on Blue
*
```

```
         IN  : 14,20,62    Blue on Gray
             username$

[ 61] take details of instructions required
    F IF       DO: Display Form

                        DETAILS OF INSTRUCTIONS REQUIRED

              Description of Information                  Date Required

             <details1$                          >     <date1      >

             <details2$                           >     <date2      >
         COL : SURR       White on Blue
         COL : 0,0        White on Blue
         IN  : 6,1,45     Blue on Gray
             details1$
         IN  : 6,54,68,0   Blue on Gray
             date1
         IN  : 8,1,47     Blue on Gray
             details2$
         IN  : 8,55,68,0   Blue on Gray
             date2


[ 62] Test variationtype                          Ex
    W IF       DO: Help Explain
         WPOS: 4,0,15,80


                   Variations and work against provisional sums

             Valuations of the work involved in and the general consequences of variations
             and instructions issued by the architect for the expenditure of provisional
             sums are dealt with in clause 13. Clause 26.2.7 covers disturbance costs
             where the introduction of the variation or work against provisional sums
             materially affects the regular progress of the works in general.

   F  AND      DO: Menu Question  variationtype$
         {F}ile                {O}ption               {H}elp

                        +----------------------+
                        ¦ NATURE OF VARIATION ¦
                        +----------------------+

                 Which of the following changes to the works defined
                 in Clause 13 as  variations was the cause of the
                 disruption?

                        1.{addition to work}
                        2.{ommision of works}
                        3.{substitution of work}
                        4.{changes in working hours}
                        5.{changes in standard of materials}
                        6.{Expenditure of provisional sums}
               AND      DO: Fail

   OR       DO: Test Expression
         prompt("Press any key to continue")
    AND      DO: Test Expression
         variationtype$="addition to work"
  +  AND [  9] conditions

   OR       DO: Test Expression
```

```
            variationtype$="ommision of works"
    +  AND [   9] conditions

     OR        DO: Test Expression
            variationtype$="substitution of work"
    +  AND [   9] conditions

     OR        DO: Test Expression
            variationtype$="changes in working hours"
    +  AND [   9] conditions

     OR        DO: Test Expression
            variationtype$=("changes in standard of materials")
    +  AND [   9] conditions

     OR        DO: Test Expression
            variationtype$=("Expenditure of provisional sums")
    +  AND [   9] conditions

     OR        DO: Test Expression
            variationtype$="II"
    +  AND [  14] explanation of variation


[ 63] timing                              Ex
   W IF        DO: Menu Question  Reasonabletime$
          WPOS: 7,15,6,50

             Was the application submitted to the Architect
             reasonable time?

                  {YES}            {NO}
                +  AND [  21] OPTION


[ 64] timing of request for instructions              Ex
   W IF        DO: Menu Question  Instruct2$
          WPOS: 6,14,9,56

              Was the request for instructions and details made
              at such a time that in relation to when it was
              required, it was not too close or far in the
              future?

                   {YES}          {NO }
                   AND       DO: Test Expression
           Instruct2$="yes"

    OR        DO: Test Expression
           Instruct2$="no"
   W  AND      DO: Display Form
          WPOS: 5,5,11,70


                Your request given your answer can be considered as
                unreasonble from the architect's point of view. Any
                claim founded on this basis would fail.



               CASE:Neodex Ltd v. Borough of Swinton & Pendlebury(1958)
          WDET: no_border replace
          COL : SURR      White on Blue
          COL : 0,0       White on Blue

   +  AND [  19] menu to quit system
```

```
| 65| written application is made                    Ex
    F IF       DO: Menu Question  WRITTENS


                    It is a requirement that a written application be made

                    to the Architect in respect of any loss and/or expense
                    that has been incurred or is likely to be incurred. Which
                    of the following situation apply in this instance?

                     1.{Application has not been made wish to do so now}

                     2.{Application already made wish to continue}



           +-----------------------------------------------------------------------------+
           ¦  {CASE LAW}          {CLAUSE 26}          {EXPLANATIONS}  ¦
           +-----------------------------------------------------------------------------+

      AND      DO: Test Expression
           prompt("Press any key to continue")
      AND      DO: Begin Explain
           notes5.80
      AND      DO: Test Expression
           WRITTENS="case law"
      AND      DO: Test Expression
           cls()
      AND      DO: Test Expression
           dos("more<","cases")
      AND      DO: Restart Rule
    +  AND |  20| Nature of written application
      AND      DO: Begin Explain
           notes7.80
      AND      DO: Test Expression
           prompt("Press any key to continue,F1 for Explanation")
    +  AND |  63| timing
      AND      DO: End Explain
      AND      DO: Test Expression
           prompt("Press any key to continue")
    W  AND      DO: Help Explain
          WPOS: 7,15,8,50

           The provisions of clause 26 are intended only
           to reimburse the contractor for losses he incurs
           as a result of relevant matters specified and
           for which the employer and/or his agents are
           responsible.
          WDET: double_border overlay
          COL : SURR      White on Blue
          COL : 0,0       White on Blue

    F  AND      DO: Menu Question  ARCREQUESTS

                      Where the Architect has requested further details
                      loss and/or expense it important that all such
                      be provided to enable a fair asecetainment to be
                      made. Which of the following situations apply

                        1.{Details of loss and/or expense provided}
                        2.{Details have not been provided}

    +  AND |  46| Response to architect request for information
      AND      DO: Begin Explain
           notes21.80



| 66|            CRYSTAL  MASTER  RULE
    F IF       DO: View Form
```

```
                    Loading the Claims Advisory System
          COL : SURR       White on Blue
          COL : 0,0        White on Blue

   AND      DO: Test Expression
          display("Please wait")
   AND      DO: Test Expression
          keywait(5)
 F  AND      DO: Menu Question  claimoption


                 What is the nature of the claim being sought?

                        1.{Time extension }

                        2.{Loss and expense}

                        3.{Fluctuation}

                        4.{Help}

                        5.{Exit}


                 -----Select one option and press enter-----
                AND      DO: Fail

  OR        DO: Test Expression
          claimoption=2
   AND      DO: Init. Variables
 +  AND |  12| evaluating loss and/or expense

  OR        DO: Test Expression
          claimoption=1
 W  AND      DO: Display Form
          WPOS: 10,21,3,37

           This module has not been installed
          COL : SURR       White on Blue
          COL : 0,0        White on Blue

   AND      DO: Quit

  OR        DO: Test Expression
          claimoption=3
 W  AND      DO: Display Form
          WPOS: 10,21,3,37

           This module has not been installed
          COL : SURR       White on Blue
          COL : 0,0        White on Blue

   AND      DO: Quit

  OR        DO: Test Expression
          claimoption=4
 W  AND      DO: Display Form
          WPOS: 10,21,3,37

           This module has not been installed
          COL : SURR       White on Blue
          COL : 0,0        White on Blue

   AND      DO: Quit

  OR        DO: Test Expression
          claimoption=5
   AND      DO: Quit
```

[var] acess1$ Ex

[var] acess2$ Ex

[var] ARCREQUEST$ Ex

[var] EMenu1$ Ex

[var] file$ Ex

[var] fname$ Ex

[var] INFORM$ Ex

[var] MENU2 Ex

[var] Nature$ Ex

[var] Reasonabletime$ Ex

[var] sitepossesion$ Ex

[var] variationtype$ Ex

[var] WRITTEN$ Ex

Appendix 11

TRETT CONSULTING

7 Ambassador Place, Stockport Road, Altrincham, Cheshire WA15 8DB. Tel: 0161 928 9004 Fax: 0161 929 1099 e-mail: trettman@trett.co.uk

Our Ref: MK/NJM/186

30th January 1997

Mr W Vidogah
University of Wolverhampton
School of Engineering and the Built Environment
Wulfruna Street
Wolverhampton
WV1 1SB

Dear William

<u>Claims Management in Construction</u>

Please find enclosed the completed evaluation forms.

If I can be of any further assistance then please do not hesitate to contact me.

Yours sincerely

M Kenyon

Enc

PETERSON CONSULTING
(U.K.) LIMITED PARTNERSHIP
HULTON HOUSE
166 FLEET STREET
LONDON EC4A 2DY
TEL: (0171) 583 0555
FAX: (0171) 583 2555

5th February 1997
Your Reference:
Our Reference: gc/pxbL242.ltr

William Vidogah
University of Wolverhampton
School of Engineering and the Built Environment
Wulfruna Street
Wolverhampton
WV1 1SB

Dear Mr. Vidogah

I enclose, a little late, my evaluation of your proposals. I apologise for the delay and hope that you find my comments useful.

Please call me if you have any further questions or require any further information.

Yours sincerely,
for
Peterson Consulting (U.K.) Limited Partnership

J. Crossley.

Garry Crossley
Senior Consultant

Enclosures:
Completed framework

May Gurney

May Gurney (Construction) Limited
Trowse, Norwich NR14 8SZ
Telephone: (01603) 627281
Fax: (01603) 665753

Please quote our reference when replying
or ask for **Mr. J W Platten**
Extension **207**

Our ref: JWP/SAK

5 December 1996

University of Wolverhampton PhD
Musa Mihsein Bsc (Eng) PhD, MBA, ACEI, FI MCCHE
MIGE C.Eng
Dean School of Engineering and the Built Environment
Wulfruna Street
Wolverhampton WV1 1SB

For the attention of Mr. W Vigogah

Dear Sir,

Re : Claims Management In Construction

With reference to your document, titled 'A framework for Better Claims Management on Construction Projects'.

Please find enclosed completed forms as requested. The framework addresses the core areas where problems do exist with record keeping, diaries, retrieval of presentation, presentation etc. Presently within our company the subject of claims and the resourcing by internal or external means leads to various meetings, debates and can we afford it.

My own personal problem regarding claims is knowing when is the best time to resource, do you set on additional staff in preparation, or when problems start to occur. With limited resources you can normally only resource externally when problems start to occur which also can be a costly method of dealing with problems.

An advantage from your proposals would be at least all data collection and retrieval systems would be standard, in place and functional.

We would be grateful if you can keep in touch with the progress of this very interesting subject.

Yours faithfully
For May Gurney (Construction) Limited

J W Platten

J W Platten

nuttall

Edmund Nuttall Ltd
Group company of HBG

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St James House
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Telephone 01276 63484
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Direct Lines
Tel: 01276 854759
Fax: 01276 854763

Mr W Vidogah
University of Wolverhampton
Wulfruna Street
Wolverhampton WV1 1SB

Our Reference
BEL/CJF/059

Your Reference

Date
1 April 1997

Subject
Claims Management in Construction

Dear William

Thank you for sending me a copy of your framework document on the above. I found it very interesting reading and it is obviously the product of in depth research and very hard work.

I have tried to view it in the light of the practical constraints that are ever present in the day to day tasks of contract management and claims recovery and trust that my handwritten comments on the attached copy of your document are of use to you.

May I wish you good luck in your future career.

Yours sincerely

Caroline Ford

p.p. B E Lloyd
Commercial Manager

Enclosure

JB/SPA

2 January 1997

Mr. W. Vidogah,
University of Wolverhampton,
Wulfruna Street,
Wolverhampton,
WV1 1SB

Dear Mr. Vidogah,

Claims Management in Construction

I now return your Claims Management Documentation duly completed.

We hope you will find our evaluation helpful in your research.

Yours sincerely,
for **FRANCIS GRAVES LIMITED**

J. BAKER

Enc:

FRANCIS GRAVES LIMITED

CHARTERED QUANTITY SURVEYORS
CONSTRUCTION COST CONSULTANTS
PROJECT CONTROLLERS
CONSTRUCTION MANAGERS
BUILDING SURVEYORS
PLANNING SUPERVISORS

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Certificate No.
FS 31017

REGISTERED IN ENGLAND
NO. 1410842

REGISTERED OFFICE:
14 THE SQUARE
BROAD STREET
BIRMINGHAM B15 1AS

3.1.9 Evaluation of Proposal 1

Proposal 1: A matrix of documents or their near equivalents that record resource use, performance and events on site with specific reference to scheduled project activities should be implemented

General Impressions

Can the recommended matrix of documents maintained as proposed aid claims preparation and information retrieval ?(Please one option)

- Quite significantly ☑
- Yes but not significantly ☐
- Would make no difference ☐

What is your opinion on the resources needed to maintain such a system of documents?

- Would be too costly to maintain at current resource levels ☐
- The long term benefits justifies any resource requirement ☑ ~~One~~ some projects.

Evaluation of the information content of proposed records

- Adequate for claims management purposes ☐
- In adequate in some respects ☑

Capacity to aid the identification and retrieval of relevant information

- Will make it easier ☑
- Will make no difference ☐
- Not sure of impact ☐

General Comments: On large projects proposal 1 is often implemented. Off-shore contracts in particular.

Document: The Activity Update Form

Impressions on the information content of the form

- [x] Adequate
- [ ] Inadequate

Ease of completing the form

- [ ] Simple
- [x] Require training to complete properly

Manpower requirement to maintain the record

- [ ] Will be comparable to current levels
- [x] Will require additional manpower
- [ ] Will require addional manpower but this outlay is marginal compared the potential benefits

Relevance of information recorded

- [x] Very useful
- [ ] Useful
- [ ] Not useful

General Comments

Training - depends who is completing form. On large projects section engineers will have work face knowledge, they will have skills etc to complete form. On smaller projects skill level may not exist.

Note: You need to consider earned man hours. Without this you may not have an early warning that there is a problem, re % age completion.

Document: Time Sheet

Impressions on the information content of the form

- Adequate ☑
- Inadequate ☐

Ease of completing the form

- Simple ☑
- Require training to complete properly ☐

Manpower requirement to maintain the record

- Will be comparable to current levels ☑
- Will require additional manpower ☐
- Will require addional manpower but this outlay is marginal compared the potential benefits ☐

Relevance of information recorded

- Very useful ☑
- Useful ☐
- Not useful ☐

General Comments

Usefulness depends in part upon programme detail, more detailed programme then possible problems in completing form.

Note: Often programmes do not identify areas or exact location of work.
ie Electrical first fix - first floor.
First floor may have 20 individual areas (offices, cells etc) - return working would not be identified by your line analysis.

Document: Plant Sheet

Impressions on the information content of the form

Adequate ☑
Inadequate ☐

Ease of completing the form

Simple ☑
Require training to complete properly ☐

Manpower requirement to maintain the record

Will be comparable to current levels ☑
Will require additional manpower ☐
Will require addional manpower but this outlay is marginal compared the potential benefits ☐

Relevance of information recorded

Very useful ☑
Useful ☐
Not useful ☐

General Comments

Refer A22

Document: The Job Diary

Impressions on the information content of the form

Adequate ☑
Inadequate ☐

Ease of completing the form

Simple ☑
Require training to complete properly ☐

Manpower requirement to maintain the record

Will be comparable to current levels ☑
Will require additional manpower ☐
Will require addional manpower but this outlay is marginal compared the potential benefits ☐

Relevance of information recorded

Very useful ☑
Useful ☐
Not useful ☐

General Comments

Document: Test Reports and Records

Impressions on the information content of the form

- [x] Adequate
- [ ] Inadequate

Ease of completing the form

- [x] Simple
- [ ] Require training to complete properly

Manpower requirement to maintain the record

- [x] Will be comparable to current levels
- [ ] Will require additional manpower
- [ ] Will require addional manpower but this outlay is marginal compared the potential benefits

Relevance of information recorded

- [x] Very useful
- [ ] Useful
- [ ] Not useful

General Comments

Document: Variation Status Report

Impressions on the information content of the form

- Adequate ☑
- Inadequate ☐

Ease of completing the form

- Simple ☑
- Require training to complete properly ☐

Manpower requirement to maintain the record

- Will be comparable to current levels ☑
- Will require additional manpower ☐
- Will require addional manpower but this outlay is marginal compared the potential benefits ☐

Relevance of information recorded

- Very useful ☑
- Useful ☐
- Not useful ☐

General Comments

Document: Record of Drawings

Impressions on the information content of the form

- Adequate ☑
- Inadequate ☐

Ease of completing the form

- Simple ☑
- Require training to complete properly ☐

Manpower requirement to maintain the record

- Will be comparable to current levels ☑
- Will require additional manpower ☐
- Will require addional manpower but this outlay is marginal compared the potential benefits ☐

Relevance of information recorded

- Very useful ☑
- Useful ☐
- Not useful ☐

General Comments

Relate to programme activity.

Ensure comments from drawing box are identified.

What about technical queries.

Holds?

Delayed access?

Document: Errors and Omission Analysis

Impressions on the information content of the form

- Adequate ☑
- Inadequate ☐

Ease of completing the form

- Simple ☑
- Require training to complete properly ☐

Manpower requirement to maintain the record

- Will be comparable to current levels ☐
- Will require additional manpower ☑
- Will require addional manpower but this outlay is marginal compared the potential benefits ☐

Relevance of information recorded

- Very useful ☑
- Useful ☐
- Not useful ☐

General Comments

PAGE NUMBERING AS ORIGINAL

3.2.1 Evaluation proposal 2

***Proposal 2:** It should be a requirement on every construction project to prepare and maintain resource leaded network schedule based on the CPM technique to aid the determination of the time and cost impact of site events on specific project activities*

Need to requiring the maintainance of schedules

- [ ] Necessary for better claims evaluation
- [x] An effective tool but it needs to be understood to aid claims evaluation
- [ ] Not required, current practice is adequate

Resource requirement for maintaining the schedule

- [x] Will be high but necessary
- [ ] Can be absorbed within current resource outlays on projects
- [ ] No apparent benefits, cannot be justified

Criteria for preparing and maintianing the schedules

- [x] Reasonable as a means of ensuring use
- [ ] Unacceptable as it requires disclosure of planned resource usage
- [ ] Needs to be enhanced further

General Comments

British Gas impose a very strict criteria for use of CPA on their projects. It may be use of you contact them.

Criteria needs to be sold on the basis that it improves management of projects, not as a claims tool.

3.3.5 Evaluation of Proposal 3

Proposal 3: It is desirable that the requirements for claim submitals be specified at project inception to ensure adequate standard of claims documentation

Clarity of proposed format

Much simpler format for documenting claims ☐

Will not be easy to prepare as proposed ☑

Information content requirement

Adequate for the stated purpose ☑

Inadequate ☐

Requires too much detailed information ☐

General Comments

Good aim, not easy to achieve in practice.

Document: Delay Cost Breakdown

Impressions on the information content of the form

- Adequate ☑
- Inadequate ☐

Ease of completing the form

- Simple ☐
- Require training to complete properly ☑

Manpower requirement to prepare the form

- Will be comparable to current levels ☐
- Will require additional manpower ☑
- Will require addional manpower but this outlay is marginal compared the potential benefits ☐

Relevance of information presented

- Very useful ☑
- Useful ☐
- Not useful ☐

General Comments

To complete the form will require a lot of effort.

Document: Disruption Cost Analysis

Impressions on the information content of the form

Adequate ☑
Inadequate ☐

Ease of completing the form

Simple ☐
Require training to complete properly ☑

Manpower requirement to prepare the form

Will be comparable to current levels ☐
Will require additional manpower ☑
Will require addional manpower but this outlay is marginal compared the potential benefits ☐

Relevance of information presented

Very useful ☑
Useful ☐
Not useful ☐

General Comments

As A44.

Note: What if planned output could not be achieved. Calculation will then be theoretical and not actual loss. Better if "Event" driven

Document: Overall Cost/Time Impact Report

Impressions on the information content of the form

- [x] Adequate
- [ ] Inadequate

Ease of completing the form

- [ ] Simple
- [x] Require training to complete properly

Manpower requirement to prepare the form

- [ ] Will be comparable to current levels
- [x] Will require additional manpower
- [ ] Will require addional manpower but this outlay is marginal compared the potential benefits

Relevance of information presented

- [x] Very useful
- [ ] Useful
- [ ] Not useful

General Comments

When many ~~events~~ events together delay an activity costing the delay per event will be difficult task.

3.4.1 Evaluation of Proposal 4

***Proposal 4:** The requirements in proposal 2 should be enforced by incorporating in contracts a standard specification for programmes of work with every standard form of contract. Such a specification should also detdil the minimum requiremtns for keeping contemporary site activity records*

General Observation		**Legal Implication**	
Current contractual provisions are adequate for claims purposes	☐	Will not significantly change current obligations	☑
Would assist and lead to better claims management	☑	Will change current obligations and encourage good practice	☐

General Comment

Many ~~programmes~~ specifications do so specify

Proposal 4.1: Enhancing contractual provisions to incorporate specification for programmes of work

General Observation		**Legal Implication**	
Current contractual provisions are adequate for claims purposes	☐	Will not significantly change current obligations	☑
Would assist and lead to better claims management	☑	Will change current obligations and encourage good practice	☐

Duty to grant time extension	**Yes**	**No**	**Not necessarily**
Extended obligation will speed up claims settlement	☐	☑	☐
Ensure a higher level of certainty of project cost long before practical completion	☐	☑	☐
Will be difficult to implement	☒	☑	☐

General Comments

Whilst the proposal may make claims easier to prepare and persue, it does not mean that they will be settled any quicker, ie can't pay / Won't pay

Proposal 4.2: Provision specifying records the contractor shouuld keep and allow the employer to audit such records

General Observation		**Legal Implication**	
Current contractual provisions are adequate for claims purposes	☐	Will not significantly change current obligations	☑
Would assist and lead to better claims management	☑	Will change current obligations and encourage good practice	☐

Duty to grant time extension	**Yes**	**No**	**Not necessarily**
Extended obligation will speed up claims settlement	☐	☑	☐
Ensure a higher level of certainty of project cost long before practical completion	☐	☑	☐
Will be difficult to implement	☐	☑	☐

General Comments

Many contacts provide for this.

Proposal 4.3:Provision requiring the contractor to submitt the build-up of costs and other bidding documents

General Observation		**Legal Implication**	
Current contractual provisions are adequate for claims purposes	☑	Will not significantly change current obligations	☑
Would assist and lead to better claims management	☐	Will change current obligations and encourage good practice	☐

Duty to grant time extension	**Yes**	**No**	**Not necessarily**
Extended obligation will speed up claims settlement	☐	☑	☐
Ensure a higher level of certainty of project cost long before practical completion	☐	☑	☐
Will be difficult to implement	☐	☑	☐

General Comments

Proposal 4.1: Provision requiring the contractor to submitt claims in a specified format

General Observation		**Legal Implication**	
Current contractual provisions are adequate for claims purposes	☐	Will not significantly change current obligations	☑
Would assist and lead to better claims management	☑	Will change current obligations and encourage good practice	☐

Duty to grant time extension	**Yes**	**No**	**Not necessarily**
Extended obligation will speed up claims settlement	☐	☑	☐
Ensure a higher level of certainty of project cost long before practical completion	☐	☑	☐
Will be difficult to implement	☐	☑	☐

General Comments

3.5.4 Evaluation of proposal 5

***Proposal 5:** To overcome the problem of document assembly, retrieval and data access in claims preparation electronic document management systems should be implemented*

	Yes	No	Not Certain
Potential benefits			
Reduce the cost of data retrieval	☑	☐	☐
Reduce the cost of managing documents	☑	☐	☐
Improve contractor's ability to substantiate claims	☑	☐	☐
Resource requirements			
May be too costly to implement on every project	☐	☑	☐
The technology			
Has a definite advantage over current document management practice	☑	☐	☐
May have to be tried to gain acceptance	☑	☐	☐

General Comments

We currently use this in persuit of claims.

3.6.3 Evaluation proposal 6

Proposal 6: Ideological training which includes the use of Information Technology for information management and claims preparation methods using project records is needed

Ideological Training

Necessary to achieve improvements in claims management ☑

Would have no effect ☐

Need for Operational Training to implement proposals

Very important ☑

Quite important ☐

Important ☐

Unimportant ☐

General Comments

Will companies make the investment?

3.7.1 Evaluation proposal 7

***Proposal 7:** On meduim to large projects the claims management function should be assinged to one member of the project team specifically trained for this task*

Assigning the function

Necessary to achieve improvements in claims management ☐ ?
Would have no effect ☐ ?

See below

Feasibility of imlenting proposal

Impratical ☐ ?
Can be implemented ☐ ?

See below

General Comments

Danger in the contractor being seen as claim buster! On some projects yes on others no - the general management of the information should be done on any event - good house keeping